M. O.; Spangler, G. W.; Speight, D. L.; Spray, P.; Stearne, R.; Stone, B. P.; Tanner, J. T.; Tanner, R. L.; Thatch, A. B.
Tomlinson, G.; University Inn, Murfreesboro; VanEys, J.; Ward, H. L.; Warren, M. E.; Wasewitz, M.; Wasmuth, C. R.; Watts, E. D.; Webster, B. H.; Weinberg, A. M.; Wescott, L. D.; White, J. W.; Wiebe, A. H.; Wilkinson, M. K.; ilson, C. W.; Woolett, A. H.; Yeatman, H. C.; Zeigler, J. E.; Zeigler, R. G.

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JOURNAL OF THE TENNESSEE ACADEMY OF SCIENCE

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ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING

GENERAL SESSION

Friday, November 19, 10:00 A.M. University Center Theater RICHARD J. RARIDON, Chairman

The Consortium Approach to the Development of New Facilities and Programs in Tennessee. Robert E. Martin, Tech Aqua Di-

rector. Financial limitations in Tennessee educational institutions often preclude the development of specialized facilities and imorien preclude the development of specialized facilities and impose restrictions on innovative programs. A trend seems to be developing in various granting agencies to support the consortium approach to the solution of these problems. The consortium approach also provides an avenue of cooperation between public and private institutions with the support of governmental The Tech Aqua Development Consortium is in its third year of operation and has identified and solved many of the problems essociated with such an operation. The summer (eaching properation of the Lech Aqua Biological Station has completed its first on site session and the continuing expansion of facilities and

program are anticipated. Enhances to Air Monitoring Project (Famp). John Judy, Rich Enhances to Air Monitoring Project (Famp). John Judy, Rich end J Matidon, and Peter H. Cohan, Cooperative Noisnes Estimated J. Matidon, and Peter H. Cohan, Cooperative Noisnes Estimated in the tests for Air Monitoring Project (VAMP) has resulted in the tests for Air Monitoring Project (VAMP) has resulted in the tests for Air Monitoring Project in the history of our nation. Nearly 31,000 public secondary school students and their tests for Tennessee reserved monitors during late March, 1971. On April 1, these sedimentation foils, control late March, 1971. On April 1, these sedimentation foils, control with adhesive, were placed in open areas where they collected insoluble particulates (dusfall) for a 30 day period. The weight gains for individual counties, in terms of tons per square mile, ranged from 3 k to 11.4, with an average county gain of 6.6. Nelected monitors were analyzed for concentrations of lead, sulfur, areanic, and various.

SECTION MEETINGS FRIDAY, NOVEMBER 19

BOTANY SECTION CIPORGE DAVIS SCIENCE, 106 B. P. STONE, Chairman

Patterns of Soluble Proteins in the Shoot Anex and Leaf Nets of Cinnamon Forn, James D. Naponetti, University of Tennessee. Acrylamide gel electrophoresis of the soluble proteins in the shoot apex and in the leaf sets of cinnamon fern, Osmunda cinnamenta to, was earlied out at three major stages of an annual eyele of development dormancy, early apring, and late summer. Typically, the shoot apex and the two youngest sets of leaf principlin have the highest protein hand numbers. The numbers decrease as the primordis become progressively older and more highly differentiated except for a slight increase of hand numbers in the oldest sets of matured leaves. Cinnamon forn produces three types of leaves; bud scales (cataphyllus), vegetative or sterile leaves (trophophyllus), and sporangia-bearing or fertile leaves (sporophyllus). The results reported here will be discussed in relation to the differentiation of bud scales, sterile leaves, and fertile leaves, and to initial leaf determination

Preliminary Investigations of the Connection Between Morphology, Habitar, and Taxonomic Designation Within the Genera, Anabaena and Nosine, J. S. Henderson and J. T. Wyatt, East Tennessee State University. Two major Nontropocean genets, Anabasia and Nostac, were extensively compared in unialgal, and in most cases, axente culture. Commonly overlapping structural properties of both generic forms in laboratory culture mandated the experimental establishment of broad physiological and morphological vatagories as prerequisite to proper taxonomic assignment. This type of pre-classification scheme was extended future in Anahuena. Most strains could be conveniently grouped as either (1) soil or terrestrial forms, (2) amphibious or semi-aquatic forms, and (3) planktonic forms, flach of these groups showed aubstantial ,and generally predictable) differences in growth tendencies and habits, structure, sensitivity to environmental atreases, and overall metabolic rates. These data suggest that conventional taxonomic treatment utilizing structural diversity are not wholly adequate for accurate taxonomic classification. Therefore we propose a thorough re-examination (simtlar to that reported herein) of vertain widely-med experimental blue green algal species in ordr to clarify prvailing literary and

Number of Relationships Between Heterocysts and Physiological Processes in Blue-Green Algae. J. T. Wyatt and J. S. Henderson, East Tennessee State University. Within filamentous blue-green algase, many different specific "roles" for the heterocyste have been suggested. We have recently examined heterocystic phenomena in about 40 species (or strains) of Nostor and Anchorna. Substantial heterogeneity in both physiological responses and heterocyst development occurs throughout the group. In some strains, external conditions seem to be primarily responsible for heterocyst production, while in others, the event appeared inherent

and predestined. The apparent involvement of the heterocyal in apparentation was irregularily expressed in different sign forms. The terrocyal frequencies fere readily aftered by manipulation of growth conditions. Contrary to the usual response, apparent levels of nitrate and anomonium ion in the growth medium did not materially decrease beterocyal production in a few strains, not materially regulated areable growth conditions, nitrogeness interpretary and the shape of the shape of

nitrogenase servey was a British Columbia Lake. Davis 1. Find-ley and Janet R. Stein, University of British Columbia and Austin Peay Ninte University. A study to evaluate the annual fluenced the combined nitrogen in Skaba Lake was undertisken. Mitrogen fixation was determined in sith by the acceptance due ton technique. Measurements of nitrogen fixation, sleaversent, nitrate and phosphute concentration were made. These results were examined in an attempt to evaluate the role of the property of the serversent of the property of the serversent of t

An Introduction to the Biology of Fremvella diplosiphon I De Toni (Morcochaste diplosiphon Comont), J. W. Jackson and De Tont (Atmetive Tennessee State University, Placed in the family Neytonemataceae by some authorities and by others in the Microchaetaceae, this infrequently encountered blue green alga often exhibits seemingly paradoxical heliavioral patiens. the rapid rate of apread over agar plates and its high overall metabolic rate are more typical of common ecologically comes. stive forms. Other than terminal heterocysts and spores, the filaments are very uniform in ragidly growing cultures. Can versely, under unfavorable conditions, extreme plemorphism de velops. The production of phycobilin pigments is very dependent upon the nature and availability of light. The sign can metabolize .01 M Sucrose while producing moderate levels of dark-growth but seems to be unable to grow in darkness at the expense of other simple earbohydrates. Although having between systs, it does not fix notrogen under seroble conditions but can utilize organic-nitrogen aubatrates as nitrogen sources.

Flowering in Neomarica gravilus Herb. Fred 11, Norts, The University of Tennessee. A clonal population of greenhouse grown plants in 1971 had a flowering period with 44 homening dates in the 120 day season from February 4 through June 2. Special interest derives from the fact that open flowers are of single day duration and opening occurs on many plants on the same day. Ninety-six per cent of the anthesis occurred on a centered one-fourth of the days of the flowering season. Study of the mechanism is being continued.

Crossing within the Cienus Celits (Ulmacea), Kansri flomprigots, Middle Tennessee State University, Crossing data adunited involving two trees identified as Celits herigata and Cooccidentals showed that both trees were self-compatable, and indicated that they are empable of hybridizing. The taxonomic implications of these results are discussed.

Breeding Systems of Pentachaeta (Compositae; Astereae). G. S. Van Horn, University of Tennessee at Chattanooga. Pentachaeta consists of six species of annual herbs, all but one of which are endemic to California. The six species were examined by the use of various anatomical and morphological techniques including studies with the scanning electron microscope. The breeding systems were examined. The finding suggest that three different breeding systems, anemophily, autogamy, and entomophily, are present within this genus. Anemophily is otherwise unknown in the Astereae and the morphological adaptations toward anemophily are unusual.

Geographic Curicular Variation in Liquidambar styractiflum Land its Relationship to Knytronmental Pollution, Jane Tyres and G. K. Sharma, University of Tennessee, Martin, Tennessee. The purpose of this study was the determination of the morphological and cuticular features of selected natural populations of Liquidambar styractiflum (sweetgum tree) and the correlation, if possible, of the culticular features with environmental pollution and or ecotypic differentiation. Severay populations Liquidambar styractiflum from Tennessee, Kentucky and Missouri, covering a wide variety of habitats were collected. With no measuring device for pollution factors, special note was made of locale and existing sources and kinds of pollution which may have affected a particular population. Cuticular imprints were prepared to study stomata, epidermal cells, trichomes, and the subsidiary

cell complex of the populations. A statistical analysis of the data on morphology and cuticular features was made. All the pupulations sampled, regardless of habital and geography, were found to have the same subsidiary cell complex. This may be of axonomic significance in this taxon. Pubescent leaf surfaces were found in the populations from relatively poduted areas where the environmental complex is made up of several conditions, factors and forces, the pattern of variations is similar. The scological significance of the patterns of variation in the sufficient features will be discussed.

Forest Vegetation - Rite Relationships to the Central Portion of the Circui Kinoky Mountain National Park. Michael Golden and II. B. Delielm. The University of Tennessee, Knoxville. Data on vagatation, topography and soils were collected from 283 one-lifth ners samples in forest stands of the central portion of the Cireat Smoky Mountain National Park during the summers of 1969 and 1970, Sampling elevations ranged from 2260 to 6490 feet, and 93 percent of the samples were taken between 2500 and 5000 feet. A total 174 plant taxa, including 72 woody take occurred in the sample plots. Importance values based on relative density (stems per sere) and relative basel area were computed for woody taxa in each sample. Samples were crouped by elevation, and by site types which were arranged from mesic to kerly, Species importance values were plotted along both site and elevation gradients. Species importance values were plotted along both site and elevation gradients. Speics designations of mesic, sub-mesic, sub-xeric, and xeric agreed well with those reported by R. H. Whittaker, notable exception being Acer rubrum and Rhododendron maximum.

Butanical Notes From Upper Rust Tennessee, Frank H. Barulay, Rast Tennessee State University. The mountainous terrain of the five counties of upper Rust Tennessee offers a remarkable variety of plant habitats.

Reliet communities include Marsh Murigold, Meadow-sweet, Colden Club and Loose-stemmed Crowfood, as well as ferna such as Climbing Pern, Created Shield Fern and common Adder's-tongue Fern. These species have previously been reported from one or another of the counties of the region. New country records for some of these, however, as well as some apparently new desords for Tennessee, have accumulated during recent years. In addition, the rather extensive herbarium of Kenneth Clarke, an M. A. thesis on the Orchidaesse by Dr. Pete Small while at E.F.S.U. and collections by R. L. James and F. W. Hehrend have added to our knowledge of plants of the northeastern Tennessee Countles.

A brand-new herbarium at R.T.S.U. contains 30 empty new cases, It is hoped that an exchange program with other inelitutions can be initiated at an early date.

Medicinal Herbs Currently used in the Appalachian Region. D. I. Pay, L. G. Phillips, A. Manning and T. G. Burton, East Tennessee State University and Kingsport University Center, Herbal medicine is still practiced in the Appalachian region in Tennessee and North Carolins, Twenty-three herbs, known to be used currently as remedies, were identified tssonomically and the correlation between the known pharmalogical properties and those properties serited to them by mountain herb collections were investigated. While a relatively low level of correnation was found with pharmacological properties, a high level of correlation was found in herb collectors' identification of pharmacologically active species, in some cases distinction was made between autspecies. A brief video tape presentation of a mountain herb collector will be shown.

A Photo-Document of Discovery and Analysis by Means of Close-up Macrophotography and Handsmale Photograms. Allison two Singel, University of Tennessee at Chattanouga. Through these techniques in photographic documentation, the student can use the photo-document of his observation as a part of solentific methodology. This documentation can assume a variety of forms and languages. However, the most fluent language, whether written or spoken, can never adequately describe or document a process or object with the exactnees of a photograph. When combined with special techniques, such as time-lapse, slow motion, macrophotography, etc., the camera makes possible the kind of analysis that leads to further research and discovery, ad infinitum.

By a comparison of students photographs we may communicate several levels of awareness of a particular subject photographed. As students photograph and compare their observations, they develop new ways of seeing that encourages further exploration.

CHEMINTY SECTION

S. K. Amer, Chairman

1, 4 fliphenyl 4 (w-nitrophenyl) larzazzle, Carl 1). Shater and Richell W. Schuberl, Memphia State University. The title some printed has been reported to be a condensation product of zinitrihenzaldehydg and phenylnitromethane. Mechanistic combigures synthesis of this estimates buch a synthesis has make higher synthesis from this estimates buch a synthesis has maken necomplished utilizing zimitzi henzisylhenzisylmethane. The rambastions of it with regard to the mechanistic details of the previously reported condensation will be deceased.

Triple Rund Parisopation in the Rearrangement of some 5. Cyclindaeyl-f-yl and 6-Claign-2 yl Trestoutiona Intermediate Vinyl Cuttons, Charles R. Hurding, The University of Tennesses at Martin The high tendency of Caystodecyn-1-yl derivatives to rearrange has been shown by several different reactions. Seduniyate of 5 syclodesyn-Lyt p mico-henzonte in 50% aquemie ethanid leads to the formation of 1 decidens as the only product. Treatment of Coycledgoyn I of with ethanelic hydrochloric acid converts with earlierd to 1 decatons. Nitrons sold desmination of syclodecynylamine nesure with partial rearrangement to 1decisions. Treatment of 4 syclodesyn-1-one with either mineral of Lewis acid gives At. 19 noted Linne as the only product. Corresponding reactions were carried out utilizing 6 netwo-2-y1 derivatives. Triple bond participation was found to occur only in the treatment of 6-notyl-2-one with acid. The results obtained in the examples involving rearrangement can be explained by invirking vinyl satten intermediates

Preparation and Properties of Ininoculturanes II. 19. Clayport and J. J. Shad Memphie State University. At the last annual meeting we reported the preparation and properties of a series of iminoculturanes (suffilmines) and several analogues of this type of compound Since our original interest in this type of compound was simulated by the fact that erms of them had exhibited antimalarial activity, we therefore prepared iminoculfuranes from several compounds with known positifugleal as livity for future study. Inimoculturanes have been prepared from phenothiszine, promazine, etheropromazine, and periodical like Infrared spectra of these compounds were consistent with those we previously reported.

Probability Distributions in Two Identical Particles in a One-Dimensional Well, C. C. Thompson and R. I. Moffman, Memphis State University The kell-known example of a single particle in a one-dimensional potential well has been extended to include two particles of identical mass. Two-particle probability densities for both symmetric and uniteymmetric space functions have been computed for a variety of quantum states. Special attention will be frequent on the differences in behavior of the probability functions for odd-even combinations of quantum numbers verus the even-even and odd odd esses. The pedagogical value of this model in illustrating the effects of spin correlation in electronic systems will be discussed.

CNDO/2 Calculations of Hydrogen Bonding, N. N. Ahmad and C. C. Thompson, Memphis State University. The utility of the Complete Neglect of Differential Overlap molecular orbital method of Pople and Segal has been demonstrated previously in calculations of hydrogen bonding interactions between small molecules. We have extended the treatment to include intramolecular as well as intermolecular hydrogen bonds in 5hydroxyl.1, 4-naphthogulnone and related compounds. These calculations indicate that conformations that permit intromolecufar hydrogen bonding are preferred over those in which only intermolecular bonding is possible. The interactions are accompanied by a slight increase in the length of the OH bond and by charge shifts from the bridging hydrogen and the ring carbon atoms to both the hydroxyl and earbonyl oxygens, Computed stabilization energies are relatively insensitive to alterations in the substituent group at the 4-position.

Approximate Radial Functions for First Row Transition-Metal 4+ and 3d Atomic Orbitals. David A. Copeland, The University of Tennessee at Mattin. The approximate 4s and 3d radial wavefunctions of Richardson, et al. [J. Chem. Phy. 36, 1057 (1962)]

for first-row transition-metal atoms and ions have been extended to additional electronic configurations. The results suggest several improvements in the 4s wavefunction parameters. Formulas are reported for extending the "double-5 3d wavefunctions over the range of atomic orbitals d' through de Theresults are intended for use in calculations of chemical bonding.

A Computer Method for Treating Multiple Electron Donor-Acceptor Interactions. Y. E. Ho and C. C. Thompson, Memphis State University. Recently, there has been increasing experimental evidence that many electron donor-acceptor systems originally thought to involve only a simple 1:1 interaction do, in fact, contain higher order complexes. The evaluation of association constants and other thermo-dynamic properties from spectroscopic measurements on systems in which multiple equilibria occur is a formidable task. We have developed a computer program that uses a search technique over a four-dimensional array to determine simultaneously the association constants and molar absorptivities for both 1:1 and 2:1 donor-acceptor interactions. The method has been applied successfully to complexes of tetracyanoethylene with aromatic hydrocarbon donors in nonpolar and slightly polar solvents.

Metal Carbonyl Derivatives of Bis-(diphenylstibino) methane. T. W. Beall and L. W. Houk, Memphis State University. Syntheses of the first metal carbonyl derivatives of a bidentate antimony ligand are reported. When the Group VIB mtal hexacarbonyls are allowed to react with $[(C_0H_2)_2 Sb]_2$ CH₂, pentacarbonyl monodentate complexes are formed initially. Extended reactions promote chelation and the formation of tertacarbonyls. The latter react with halogens to yield nonsaline, seven-coordinate tricarbonyl derivatives of the type $M(CO)_3$ (dsb)X₂. Proposed structures and bonding characteristics are discussed based on nectral data

A Magnesium Treatment for Inhibiting the Dezincfication of Brass in Water, C. R. Schmitt, Union Carbide Corporation, Nuclear Division, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. The rate of dezincfication of a brass valve exposed to demineralized water at 160° F was found to be linear with exposure time up to 162 hours. When approximately 10-20 ppb magnesium was dissolved in the water prior to exposure with brass, the rate of dezinchcation of the brass at 160° F was greatly reduced. In a study of the mechanism of corrosion inhibition of the magnesium-passivated brass by spark source mass spectrometry and electron microprobe analyes, it was confirmed that magnesium was present as an integral part of the corrective film or coating on the brass surface. The corrosion resistance of an untreated and a magneium-treated valve was also evaluated in an accelerated corrosion test using a synthetic sea water at 25° C, and after a six-month immersion period, the magnesiumpassivated brass had shown considerably less corrosion

The Determination of Activity Soefficients of HCI in 2-pyrorolldone Over the Temperature Range 25 to 50°C. William H. Zuber, Jr. and J. H. Jackson, Memphis State University. The standard reduction potential of the silver-silver chloride electrode was calculated from EMF data. The cell used can be represented by:

Pt, H_a/HC1(m)/ AgC1.

For the temperature range 30 to 60°C E° can be represented by E° = 2.507229...1.13943 x 10°T + 1.60000 x 10°T.

From these data the activity coefficients for HC1 in 2-pyrrolidone over a range of concentrations from 0.0005 to 0.0250 motal were calculated and compared to those calculated using a simple Debye-Huckel "limiting law".

Technique for Professing Small Samples of Electromagnetically Separated Mercury Instoper. E. W. McDaniel, L. Ö. Love, A. M. Veach and F. B. Thomas (Retired). Oak Ridge, National Laboratory. Isotopically enriched samples of mercury in milligram quantities are collected in continuously renewed films of Octoid-6. Energetic iones, produced in culturions, carbonize the oil film, thus forming a solid mans which retains the mercury even in the presence of 16° Torr. The steps involved in the recovery and purifications of an Inste as one milligram of mervarry from this carbonized mass include degressing, removal of coury from the backing plate, vacuum distillation of the mervary from the backing plate, vacuum distillation of the meruevals, and subsequent electrodeposition of mercury outs gold foil. Nearly all our output capacity for Hg-196 is channeled into medical unce, other isotopes have limited medical applications and are sought in determinations of nuclear properties.

A Review of Tennessee's High School Chemistry Teacher Certification Requirements. DeWitt B. Stone, The University of few as eight semester hours of college chemistry and certification to teach high school chemistry. The stronger, single-subject college chemistry. These requirements fall short of the 1960 Cooperative Committee on the Teaching of Science and Mathematics. A survey of eight states (Colorado, Illinois, Strucky, geographically encircle Tennessee, shows their average resistry for "general" and "specific" certification for high school chemistry. Some upgrading of Tennessee's requirements seems

ENGINEERING SECTION GEORGE DAVIS, SCIENCE, 130 JAMES B. DELANO, Chairman

Technology in a Real-Life World: a Panel Discussion. Introduction. James Delano, Tullahoma. Large segments of our population cannot understand why our country whose sciences and technologies have made prodigious advances is allow and even reluctant - to respond to the solution of problems concerning the "basic needs" of society. Some of the problems concerning the society's basic needs are not new ones: large segments of the world population need food, shelter and potable water; the land, atmosphere and waters are becoming even more polluted; natural resources are dwindling because of wasteful practices; our cities are decaying and people are living among mastes which are not easily disposed; and in addition, methods for administering health care are needed.

The purpose of this panel discussion is to explore some of the problems concerning the interactions of technology and society:

How should we communicate with each other for each to respond to the other's needs?

What direction should education take in our colleges and universities?

What can be done with our vast technological, educational and governmental disciplines to meet the needs of the real-life world?

Some Cybernetic Aspects of Community-Technology Interactions. T. Charles Helvey, University of Tennessee Space Institue. A few minutes will be devoted to introduce Cybernetia and explain some of the controversial definitions of this new science. There is no question about it that in our democratic society the subset of the community and the subset of technology are in close interrelation and interdependencies. Although this fact is well known to almost everybody who is involved in any phases of the structuring or promoting of these two subsets. However, not enough people are familiar with the value of the approaching of all the problems from the overall systems point of view. The major part of the presentation is devoted to the demonstration how direct, as well as second and third order interactions play a major part in the establishment to the homeostatis parameters of both systems. Besides some theoretical explanations, practical examples will be quoted in which the Cybernetic approach to problem solving in such areas as sociodynamics and technological achievements are working together for the benefit of the community.

Physical Scientists, Engineers, and Social Problems. David H. Grubba, Middle Tennannee State University. Many social problems confronting all levels of government both here and abtund have certain aspects about them that lend themselves to treatment by the methods, techniques, and mental attitudes toward problem solving that have been developed by the psysical scientists and engineers. Interest has already been shown by some scientists and engineers in attacking certain problems of society, and great strides forward already have results in some cases and high expectations exist for break-throughs in other exists key areas.

For example, the process of communication has been inmeasurably improved through the combination of rocketry and sophisticated satellites. Transportation breakthroughs such as the Bay Area Rapid Transit program are heavily dependent on relatively recent development in systems analysis and computer technology. Certain development in riot control and criminal detection, though controversial to some extent, show that physican scientists can make strong inputs into attempts to deal with social problems.

It is the thesis of this paper that though there are encouraging signs of interdisciplinary work between social scientists and political scientists and engineers, this proces has not proceeded far enough, fast enough, or deep enough. A call is made for an analysis of social and governmental problems by interdisciplinary teams so that full utilization can be made of the special competencies available in the various fields.

Educating Engineers for the Last of the BJth Century. Edward M. Dougherty, President, Aronetic Inc. Tullahoma, Tennessee. The rules of the economic game are being changed rapidly. It is no longer sufficient that one have the capital and know-how to produce and market a product that satisfies the customer. Now one must also do it in a manner satisfactory to the employee, the Government, and the bystander who may be standing or living nearby. All this, of course, must still be done competitively.

Universities in the past have not been noted for their responsiveness to the needs of the real world. The desires and talents of the Educators, as would be expected, have frequently taken precedence over outside demands with the possible exception of some professional schools.

Engineering Colleges, while subject to the same internal influences as the rest of the University, have made an attempt to meet a real need. Now the demands are growing so broad and the problems that require solution are so complex, sophisticated and inter-related, industries of the future will have great difficulty spelling out their needs even should the Colleges pledge themselves to meet thm.

The result, I believe, will be an Engineering College System of greater diversity than we know today. One College curriculum and instructional technique will resemble others only in outward form sufficient to get accredited while the students would hardly recognize they had worked for the same degree. Such diversity may be our salvation.

GEOLOGY AND GEOGRAPHY SECTION OLD MAIN, CBJ

F. T. FISCHER, Chairman

An Empirical Approach to Limestone Classification Via a Computer Model. David N. Lumsden, Memphis State University, Limestone classification schemes have evolved through observation and testing to the point where a satisfactory framework, adaptable to almost any study, now exists. In the hopes of gaining insight into underlying cause and effect interactions between five constituents of a limestone, micrite, spar, fossils, coated grains, and oolites, a computer program was evolved in which these constituents interact to form mathematical "rocks." Each constituent was assigned a continuous distribution function (normal, lognormal or expotential) which were constrained to vary from zero to unity along the x axis. The means, standard deviations and expected values were varied. At points secalculated and the "rock" then assigned a position in one of lected along the x axis the proportion of each constituent was several enassification schemes tested. Results so far obtained have not revealed a scheme in which the "rocks" were classified into natural and unique categories. Definitions of classification bounduries play an important role in results obtained

The Sandstone Sinkholes of the Cumberlands. Philip J. Lorenz, The University of the South, Ward Resser, North Carolina School of the Aris. Twelve large sandstone sinkholes on the Cumberland Plateau in or near Grundy County, Tennessee, were investigated. All sinks were excavated in the Crab Orchard Parnation (Sewanee Conglomerate) and were found to be located within a few hundred feet from the escarpment along an axial plane running southwest to northeast. The average sinkhole studied was about ninety feet deep and 440 feet in diameter. However, the range is from small shallow depressions to large structures that were difficult to distinguish from hollows or coves. (Water-filled sinkholes in sandstone will be reported

later.) The survey was concluded with a detailed study of the large sinkhole atop the western escarpment of Burrow Cove.

"The Barrens" A Study In Geographic Terminology. William W. Chester, The University of Tennessee at Martin. The term barren is, in many instances, an incorrect use of terminology to identify certain geographic phenomena. For example, many writers incorrectly identify glades as barrens and others use these terms interchangeably. The purpose of this paper is to advance two origins of glade formations and show their functional use in select areas of so-called "barrens" in Kentucky and Tennessee. Numerous writings concerned with the barrens in Kentucky and Tennessee were reviewed for background data. Inaddition, the so-called "barrens" of West Tennessee were investigated during various field excursions. After working in the area, it is the opinion of the writer that serious consideration should be given toward elimination of the term barren and embrace the term glade to identify the geographic features discussed in this paper.

Several Geological Applications of Radar Imagery. G. K. Moore, U. S. Geological Survey, Water Resources Division. The geological features that are visible on radar imagery of Tennessee include bedding, faults and other lineations, large sinkholes and quarries, strip mines, anticlines and synclines, and a dome, hitherto ummapped. Everything visible on radar imagery also is visible on aerial photography, but subtle topographic features are enhanced by shadowing on radar. Thus, some geological features also are enhanced. Other unique advantages of radar are an all-hour and all-weather capability, target illumination from any azimuth and from almost any vertical agle and both like and cross polarized returns.

Future of the New Earth Science Program in Tennessee Secondary Schools, R. Jerry Rice, State Department of Education, and James X. Corgan, Austin Peay State University. Earth science was officially added to the secondary school curriculum in Tennessee during the 1969-1970 school year. Nine school systems offered earth science to their eighth and ninth grade students. In 1970-71, fifty-seven school systems adopted an earth science textbook as a basal text, and twenty-seven additional systems adopted an earth science textbook as a supplementary text for eighth or ninth grade programs. In 1971-72, 95% of Tennessee school systems offer earth science or an earth scienceoriented general science course. Rapid growth of the earth science program poses many problems. If the program is to succeed, Tennessee colleges and universities must provide trained teachers; the schools must view earth science as a significant profesional specialization: educators must continue to encourage a variety of innovative approaches to earth science instruction; and Tennessee's practicing earth scientists must regard the secondary school teacher as a fellow professional.

Multi-well Limestone Aquifer Test. J. M. Wilson, J. M. Kernodle, Tenn. Division Water Resources, and F. G. Stearns, Vanderbilt University. In October 1971 a nine-well limestone aquifer fer (pumping) test was conducted in Wilson County near Mt. Juliet, Tennessee. Preliminary figures indicate a porosity of .003 percent for the Carters Limestone. Water levels were measured prior to the test to establish the static water level, and gamma-ray logs were run to establish geologic contacts. Unusual features of this test are the large number of observation wells and the amount of data available for analysis. Malfunotions of the generator on the first day of the test caused on and off operation of the pump. This resulted in additional aquifer development. Static water level in the pumping well and the four wells to the north rose 2 feet. To the southwest a decline of almost 2 feet resulted. Originally, the gradient of the water table was 47.3 feet per mile. After the water level adjustment the gradient was 16.8 feet per mile. This change (apparently permanent) existed for several subsequent works own though rain recharged the aquife. Some of the thoughts about what caused the decrease in gradient are: (1) Devatering of part of the aquifer, and (2) Aquifer development (increased) horizontal and/or permeability).

Clay Mineralogy of Tennessee K-Bentonites, R. W. Lounsbury, Memphis State University, and W. N. Melhora, Purshe University, Altered volcanic ashfulls of Ordovicium ago occurs in sorprising thicknesses in central Tennessee and in the Chattanoogs area, Exposures 3.5 to 5 feet thick were observed in the field. The volcanic origin of these interesting deposits is observed indicated by the textures, mineral compositions, and field relations. Samples collected obserly in the Nutrielle and Chatta-

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nooga areas have been compared with others collected over an area of nearly one million square miles from New York to Alabama and Missouri and from units of Devonian age. The clays in these horizons have been variously described in the past as potassium bentonite or K-bentonite and metabentonite. X-ray, thermal and optical analyses indicate that these deposits are chiefly mixed-layer clays. Illinite greatly exceeds monmorillonite in the interstratified clay. These clays are much less expansive than the montmorillonite of smectite bentonites of the

Tidal Glat Deposits in Upper Ordovician Rocks Exposed along Interstate 75 between Chattanoog and Cleveland, Tennessee. Richard E. Bergenback, University of Tennessee, Chattanooga. A sedimentary rock sequence composed from the base up of thinly interbedded carbonate and gray shale, poorly bedded calcisiltite, red- and green-mottled mudstone, calcirudite, and calcarenite, and gray orthoquartzitic sandstone. This sequence is interpreted to have formed during a regression in shallow marine,

near-shore environments. The Wells Creek Formation in Central Tennessee. Ray C. Gilbert, The New Jersey Zinc Company, Carthage, Tennessee. The Wells Creek Formation, as known from two surface exposures and about 600 drill penetrations in Central Tennessee, is the lowermost Middle Ordovician sediment. It typically contains a basal conglomerate in a green argillaceous dolomite overlain by a more massive dolomitic limestone. This formation fills the topographic lows in the topography developed on the post-Mascot erosion surface. The two units of the formation are distinct in some areas of the Central Basın but are inter-layered in other areas. The information was apparently deposited in a relatively shallow water under stable conditions. The correlation of the Wells Creek can be made only in a gross way, and the details of correlation must await a more complete knowledge of the regional distribution of the lowermost Middle Ordovician

Stones River Group Stratigraphy of Middle Tennessee. Alan K. Stagg, The New Jersey Zinz Company, Middle, Tennessee. The Stones River Group of Middle Ordovician age has been studied in some detail in those portions of the Central Basin of Tennessee in which it crops out. However, little information concerning this unit has been available in those areas where it occurs in the sub-surface; the data available have consisted primarily of cuttings from oil test wells which allowed only gross correlations. An extensive core drilling program by The New Jersey Zinc Co. in Middle Tennessee and portions of Southern Kentucky, which resulted in the discovery of major zinc deposits in the underlying Knox Dolomite, has afforded an opportunity to acquire detailed stratigraphic information on the Stones River Group in the sub-surface. Detailed stratigraphic correlations have been made which have resulted in the redfinition of the Wells Creek Formation, the recognition of an unconformity at the top of the Murfreeshoro Formation, the identification of several distinct facies of the Pierce Formation, and the presence of a massive, mottled bed at or near the top of the Lebanon Formation in the northeastern part of the area. Tentative correlations with equivalent rocks in central Kentucky can be made from the information now available.

MATHEMATICS SECTION GEORGE DAVIS SCIENCE, 120 JAMES M. DORAN, Chairman

Concerning E-Inversive, Rectangular Semigroups, David A. vestigation of the set of idempotents for an E-inversive, Rec-Stulns, Tennessee Technological University. This paper is an intangular Semigroup. Necessary definitions will be stated and two lemmas will be proved. With the aid of these lemmas, the following theorems and a corollary will be proved

Theorem 1. Let S be an E-inversive, Rectangular Semigroup. If x is an element of S1, then there exists idempotents e and f in S such that x-ef-xf-exf.

Theorem 2. Let S be an E-inversive, Rectangular Semigroup. Let E be the set of idempotents for S, let e be an element of S. Then E is left [right] zero if and only in Se=S1 [e5=S1] and eS[Se] is a group.

Derivation of Integral Identities Using Complex Integral Derivation of University of Tennessee at Marting

No have used residue theorem to find the following

f(z) has a period 2% and is analytic within and on a closed contour f consist-ing of a semicircle of radius R im upper half plane and real axis from -R to approach

(ii)
$$\lim_{R \to \infty} |R^{-1}f(Re^{i\theta})|^2 = 0$$
 for $0 \le \theta \le \eta$

$$\frac{\text{then}}{(1.1)} \int_0^{\pi} \frac{f(\log x) \, dx}{x(1+px) \left[\pi^2 + (\log x)^2\right]} = \frac{f(\pi i)}{1-p} \frac{f(\pi i - \log p)}{\log p}$$

(i)
$$\lim_{R \to \infty} |R^{S-1}f(Re^{i\theta})| = 0$$

(ii) $\lim_{\rho \to 0} |\sigma^{S}f(\rho e^{i\theta})| = 0$

(ii)
$$\lim_{\alpha \to 0} [\sigma^{S}f(\rho e^{i\theta})] = 0$$

(iii) f(z) is an entire function, then

$$(1.2) \int_0^{\infty} \frac{f(x) x^{s-1} dx}{p+x} = \frac{f(-p) x p^{s-1}}{\sin xs}$$

Replacing p by L in (1.1) and 1/p by L in (1.2), where L is a linear operator associated with γ with inverse L⁻¹, and applying the operators on $\phi(\gamma)$ was

nave
$$(1.3) \int_{0}^{\infty} \frac{f(\log x)}{x[\pi^{2} + (\log x)^{2}]} \begin{bmatrix} x \\ z \\ -(-)^{n}x^{n}L^{n}\phi(y)]_{dx}$$

$$= f(\pi i) \sum_{n=0}^{\infty} L^{n}\phi(y) - \frac{f(\pi i - \log L)}{\log_{\pi} L} \phi(y)$$

and
$$\int_0^\infty f(x)x^{S-1} \{ \sum_{n=0}^\infty (-)^n x^n L^n \phi(y) \} dx$$

$$(1,4) = \frac{\pi}{\sin \pi s} \{f(-L^{-\frac{1}{2}}) \ L^{-\frac{1}{2}}\phi(y)\}$$

With L \equiv λE^{ii} , where E is shift operator defined by Eb(y) =b(y+1),

$$\int_{0}^{\infty} \frac{f(\log x)}{x[\pi^{2} + (\log x)^{2}]} \left[\stackrel{\omega}{f}_{m=0} (-\lambda x)^{m} \phi(y + \mu n) \right] dx$$

$$(1.5) = f(\pi i) \int_{n=0}^{\infty} \lambda^{2n} \phi(y+\mu n) + \int_{n}^{\infty} \lambda^{2n} f(\pi i - \log \lambda - \mu D) \phi(y+\mu x) dx$$

where $\phi(=)=0$ for $\lambda=1$, and $\phi(=)=\lambda$, a finite quantity for 1<1.

 $f(z)=e^{-\Delta z}$, a non negative integer, satisfies the conditions of result λ , and substituting it in (1.5) we get

$$(1.6) \int_{0}^{\infty} \frac{\left[\sum_{n=0}^{\infty} (-\lambda x)^{n} \phi(y+\mu n) \right] dx}{x^{2+1} \left[\pi^{2} + (\log x)^{2} \right]}$$

$$= (-)^{2} \prod_{n=0}^{\infty} \lambda^{n} \phi(y+\mu n) +$$

$$(-\lambda)^{2} \int_{0}^{\infty} \lambda^{X} \phi(y+\mu a+\mu x) dx$$

 $(-\lambda)^2 \int_0^{2\pi} \int_0^{2\pi} e^{(y+\mu a+ux)} dx$ Similar results can be obtained from (1.2). The technique can be used to obtain many more such identities

Corollary to Theorem 2. If S is an E-inversive, Rectangular Semigroup, then S² is a group if and only if S Contains exactly

Inflation of a Semigroup Whose Square is a Group or the Union of Two Groups. Reginald Mazeres. Tennessee Tech. This paper will prove two theorems. Frst, any semigroup whose square is a group is an inflation of its square. Second, any semigroup whose square is the union of two groups is an inflation of its square.

SCIENCE-MATHEMATICS TEACHERS ASSOCIATION

GEORGE DAVIS, SCIENCE, 120 JOHN R. FREEMAN, Chairman

Factors Related to New Physics Course Adoptions in High Schools, John F. Yegg*, Harvard Graduate School of Education. Cambridge, Massachusetts. Two related nationwide studies of decision-making in high school physics course adoption processes were conducted. In all, nearly 700 teachers who had attended (Harvard) Project Physics summer institutes were studied and relationships between a large number of variables and each teacher's adoption or non-adoption of the new course were sought. Analyses of cross tabulations of data revealed relationships well beyond the levels attributable to chance. A factor analysis of variables significantly related to course adoption identified five essentially independent groups of interrelated variables. In most cases the clusters of variables wre even more strongly related to adoption than any of the components in the factor. Recommendations are made to facilitate the adoption of new science courses in the light of the findings of the study. (This work was supported in part by a research grant (GW 5210) from the National Science Foundation.) *Present address: Special Training division, Oak Ridge Associated Universities.

Development of an Auto-Tutorial Course in Nuclear Medica Technology. Jerry B. Minter and Robert M. Beihn, Special Training Division, Oak Ridge Associated Universities. The instructional content of the Special Training Division's four-week residence course in nuclear medical technology is being adapted to a multi-media, auto-tutorial format. The course is designed to be offered to medical technologists undergoing on-the-job training in nuclear medical technology. Instruction will be accomplished in a study carrel placed in the technologist's hospital. Several hospitals in the Oak Ridge area have requested that the course be field tested and evaluated in their facilities. This work is being done under the auspices of Grant No. 1 DO2 AH 01048-01 from the Bureau of Health Manpower Education of the Department of Health, Education, and Welfare,

"Tech Physics"-Developing a Course of Study in Physics for Technician Training in Two-Year Colleges. L. K. Akers and John F. Yegg, Special Training Division, Oak Ridge Associated Universities. A new course of study in physics at the two-year college level for future technicians is in an early stage of development under an NASW grant to the American Institute of Physics. The course is being designed to achieve utility for the broad spectrum of physics students in technical colleges through the use of the "modular" format. The teacher, in essence, is able to tailor his course to suit his students by selecting a sequence of semi-autonomous modules that focus on the objectives and needs of the students. The initial module development is being conducted in four "centers" throughout the countryone of them in Tennessee. This paper summarizes the effort that has been expended to date and focuses on the module development experiences at the Oak Ridge center. Cooperative efforts have already been established with some state two-year colleges; further collaborative efforts will be encouraged.

MEDICAL SCIENCES SECTION GEORGE DAVIS SCIENCE, 131 B. R. JENNINGS, Chairman

Termination of Immune Tolerance to Rabbit Gamma Globulin in Mice with Rabbit Antibodies to Mouse Antigens. C. M. Haire, University of Tennessee. In the first month of life, 175 Tennessee Swiss mice were renderd tolerant to rabbit gamma globulin (RGG). At two months of age, the males and females were each divided into four experimentanl groups, which received six twice-weekly injections of either rabbit anti-mouse serum albumen (RAMSA), rabbit anti-mouse gamma globulin (RAMGG), rabbit anti-mouse lymphocytes (RAML), or normal rabbit gamma globulin (NRGG), all in the ultracentrifuged form. Titered for anti-RGG, the mice receiving RAML globulin appeared to have escaped tolerance. The regimen was repeated at a higher dose, resulting in a more dramatic re-

To confirm the findings, the three groups of male mice not receiving RAML globulin, were each divided into two subgroups, one receiving a six-dose regimen of NRGG and the other receiving RAML globulin. Again, the latter sugroups escaped tolerance to RGG.

Sources of Lead Contamination in Mainand Its Possible Consequences. Henry A. Moses, Linwood Townsed and Sharon Watkins. Meharry Medical College and Fisk University. Lead analyses were performed on rainwater samples collected over a four month period (from June 19, 1970 through September 20, 1970) in low-congested area while the rainwater from the high-congested area had a range of 7.8 to 172 micrograms of lead per

Further, analyses were performed on selected foodstuffs, thought to be common among the diets of lower income urban residents, for the purpose of ascertaining the possible degree of lead intake of these residents. Lead was found in all of the foodstuffs analyzed with subterraneously grown vegetables being

The implications of the results obtained show that these people may be on the brink of developing chronic lead poisoning. The biochemical implications of the consumption of lead are

Comparative Rates of Infection in the Use of Indwelling Cenous Catheters Vernus Intravenous Needles. Claude P. Ledes, University of Tennessee, Memphis, Nosocomial infections infections caused by indwelling venous catheters among hospitalized patients represent a serious health problem. A number of studies have documented the rate of infection noted in the use of these batheters and a few studies have suggested that the indwelling intravenous needle may have a lower percentage of infectious complications. This is a unique study which compares both techniques in a large municipal hospital population. Two hundred medical and surgical ward patients were studied and 217 cultures made. Of these, 179 were catheters and 38 were scalp vein needles. There were 40 positive cultures, and two cases of sepsis, one fatal. The percentage of positive cultures for pathogens increased with the time the devices were in place. The percentage of pathogens recovered from cultured catheters was 11.7 and from scalp vein needles 2.6. It is suggested that the rate of sepsis is significantly lower with the use of needles, and the rate of positive cultures increases with the number of hours the intravenous device remain in place.

Anti-tumor Antibodies in the Sera of Mice Prior to the Observation of Spontaneous Mammary Tumors. James M. Mason. and B. R. Jennings, Univ. of Tenn. Med. Units, Memphis, Tenn. A 0.2% sodium deoxycholate extract was prepared from washed mammary tumor cells taken from inbred Hale-Stoner strain Swiss mice. This extract reacted in agar-gel double-diffsuion with the serum of a 14 month old female mouse without a tumor, forming a single precipitin line, This antigen was found to migrate toward the anode and to react with the serum from tumor-bearing mice using immunoelectrophoresis. Since antibodies migrate toward the cathode under these conditions (pH 8.6 and ionic strength = 0.235), it was possible to devise a system in which this antigen and antibody were migrated toward one another. This was observed to be a rapid and sensitive test for anti-tumor antibodies with precipitin lines usually forming within 30 min. Using this technique the sera of all eleven mice tested were shown to contain these antibodies before any developed a palpable mammary tumor. These antibodies were not found in the sera of young adult (approximately 3 month old) female mice of this strain.

Stable Tracers for Clinical Studies on Human Subjects. N. C. Dyer and A. B. Brill, Vanderbilt University. The use of radioactive tracers for the study of metabolic processes for normal and diseased states in human subjects is a well established practice. In human subjects who have a high risk to ionizing radiation exposure such as pregnant women and infants, the use of radioactive tracers is often not justified especially in situations where the results of the study will not be of direct benefit in the medical management of the subject.

We have developed techniques for stable tracer studies for use on such high radiation risk populations. With a stable tracer study, a non-radioactive, rare isotope is given to the subjects. Blood and biopsy samples are taken from the subjects and the amount of stable tracer is quantitated in the samples by neutron activation analysis. Since the irradiation of the samples is done *in vitro*, there is no exposure of the patient to ionizing radiation. Stable tracer studies using *s*Cr on newborn infants with respiratory distress and *s*Fe for iron metabolism of pregnant women will be discussed.

PHYSICS AND ASTRONOMY SECTION GEORGE DAVIS SCIENCE, 121 W. E. HUNT, Chairman

Understanding the Very Complicated Eclipsing Binary Star RS Canum Venaticorum. Douglas S. Hall, Dyer Observatory, Vanderbilt University. RS CVn suffers from a greater variety of complications than perhaps any other eclipsing binary. To explain to all of these I propose the following model. There is a region of tremendous sunsport activity darkening one hemisphere of the cooler star within ±30° of its equator. This explains (1) the wave-like distortion in the light curve outside eclipse, (2) why secondary eclipse has a 10% shorter duration than primary, and (3) why primary eclipse is about three times deeper than expected from the relative surface brightnesses of the two stars. If the cool star is rotating differentially, as our sun does, then the equatorial region will rotate slightly faster than an intermediate "co-rotating latitude" which rotates in synchronization with the orbital motion. This explains the migration of the wave-like distortion towards decreasing orbital phase, and also the variable depth of primary eclipse. Violent chromosperic activity associated with the sunspot region can explain the strong Ca II emission observed spectroscopically. Violent flare and/or prominence activity and consequent mass ejection can explain why the orbital period is so badly variable even though neither star fills its Roche lobe. The abrupt period change in 1964 was a decrease, consistent with the fact that the dark region was then on the leading hemisphere. To explain why the cool star has such violent sunspot activity and why it lies above the main sequence, I suggest that RS CVn is a very young binary with its cool component still in gravitational contraction. This research was supported in part by National Science Foundation Research Grant GP-9895.

The Nearly Contact Eclipsing Binary Star BV 346. Robert C. Tate and Douglas S. Hall, Dyer Observatory, Vanderbilt University. Edward W. Burke, Jr., King College. The eclipsing binary star BV 346 was observed photoelectrically in blue and yollow light on 17 nights in 1969 at the Kitt Peak National Observatory. Four minima were observed from which the period was found to be 1.4.252387, Communication with Dr. Strohmeier, Remesis Observatory, Bamberg, Germany, provided 14 more minima which confirmed the period and improved the accuracy. The B and V light curces, corrected for atmospheric extinction and reduced to heliocentric time, were rectified for ellipticity and reflection, and solved for the elements in the usual way. Because the eclipses were shallow (0m.5 from maximum to primary minimum) and became even more shallow after rectification, no unique solution could be found for the critical element k, the ratio of radii. We found, however, a family of solutions which faithfully represent the observations. Spectroscopic information provided by Dr. Popper, U.C.L.A. suggests a value of $k \approx 1$. The ratio of the depth of primary and secondary minimum indicates the system is composed of two main-sequence stars of spectral type B8 and B9. Although the value of k is not uniquely determined, it can be shown that, over the entire range of permissible solutions, the system is very nearly contact,

This research was supported in part by National Science Foundation Research Grant GP-19895

A Doughnut-Shaped Star in the Very Young Eclipsing Binary BM Orionis. Douglas S. Hall, Dyer Observatory, Vananderbilt University. A model is proposed to explain why the early B star is seen in the spectrum, whearas the light curve seems to predict an equally bright cooler star which should be sen alone at supposed totality. The cool star is assumed to be a disk-shaped object, similar in shape to that proposed by Huang for E Aurigase, seen nearly edge on By means of write.

E Aurigae, seen nearly edge-on. By means of various restraints it is estimated that the disk covers about 55% of the B3 star at primary eclipse. This leads to the relative luminosities, the color of the disk, the relative geometrical dimensions, and the orbital inclination. The model with these parameters predicts

a theoretical light curve which represents the observation quite

well.

The mass-luminosity relation applied to the B3 star, along with the mass function, leads to the following absolute dimensions: The B3 star has a mass of 5 M. and a radius of only 2.5 R; the disk has a mass of 3 M., is 15 R in diameter, and 3 R. in thickness.

3 R. in thickness.

A biconcave disk structure, such as calculated for the primary differential rotation, could satisfy the stringent requirement that the top and bottom of the proposed disk appear exactly flat in projection.

actly flat in projection.

This research was supported in part by National Science Foundation Research Grant GP-19895

ation Research Oran Effect of a Conduction Current on Elas. Investigation of the Light Steel Bar. F. L. Culp, Don Blas. tic Waves in a Magnetized Steel Bar. F. L. Culp, Don Brown, Tongate Tennessee Technological University and Dorris Tongate, Tennessee Technological University, A and Dorris Tongace, A semployed to investigate the effect between two curso or a soft steel magnetized bar sandwiched vertical arrangement of a soft steel magnetized bar sandwiched vertical arrangement on elastic waves in the steel of conduction current on elastic waves in the steel bar. The of conductioncurrent car steel bar was magnetized by a surrounding solenoid, while the steel bar was imaging the steel bar was imaging the steel bar was were generated by dropping a weight onto the top of the column-like assembly. The output of a pick-up col top of the committee and the steel bar was displayed on an oscillowhich surrounded the scope screen and photographed. It was also investigated with a scope screen and photography which are made with no current wave analyzer. Initial observations were made with no current in the steel bar. Spectrum analysis revealed principle frequency components of 5, 10, and 15 kHz, plus a weak 2 kHz signal The first three signals were identified as standing waves in the the first time steel bar, with the 5 kHz signal representing the fundamental frequency of the longitudinal wave. The 2 kHz frequency, also identified as a damped standing wave, was associated with the entire vertical assembly; hence, the wave crossed the boundaries between the steel bar and the Cu-Be bars. Observations were repeated under identical conditions with one exception—viz., a current of several amperes was sent through the steel bar. The presence of the current in the magnetized steel bar dramatically enhanced the 2 kHz signal, demonstrating that this frequency was able to pass through the Cu-Be-steel interfaces much more readily than before. Analysis of this effect suggests that the current changes the acoustic impedance in the steel bar by causing a change in the speed of the longitudinal elastic waves. The evidence indicates that a more direct experiment should be performed to test the above implication.

Level Schemes of ¹⁸⁸Gd and ¹⁸⁸Sm. A. V. Ramayya, J. H. Hamilton and K. R. Baker, Physics Department*, Vanderbilt University. Silgles and multiparameter coincidence experiments were performed on the decay of 12.6y¹⁸⁹Eu. Approximately 30 new y -rays were observed in ¹⁸⁸Sm and ¹⁸⁹Gd. Of particular importance is the precise determination of the intensity of close lying lines. Three interband y to B band transitions were confirmed in ¹⁸⁵Sm by our coincidence data as well as a transition from the 4*y to the 3*, K= 0 octupole state. New levels not previously reported or confirmed by coincidence data include 1650.4, 1680.0, and 1757 keV in ¹⁸⁸Sm and 1282.5, 1318.6, and 1550.1 keV in ¹⁸⁹Gd.

Gamma-Gamma Directional Correlations of Transitions in 13xTe. K. R. Baker, J. H. Hamilton, A. V. Ramayya and G. Highlad Physics Department, Vanderbilt University. Gamma-gamma directional correlation measurements were made on nine transitions in 13xTe with a NaI(T_t) - Ge(Li) detector arrangement and multichannel analysis. The multipole mixing ratios obtained were \$\frac{1646}{2000} = 0.000 \times 0.001 \times \frac{1741}{2000} = 1.5 \pm 0.000 \times 0.001 \times \frac{1741}{2000} = 1.5 \pm 0.000 \times 0.000 \times 0.001 \times \frac{1741}{2000} = 1.5 \pm 0.000 \times 0.0000 \times 0.000 \times 0.0000 \times 0.000 \times

tained were $\delta(646) = 0.000 \pm 0.001$, $\delta(714) = 1.5 \stackrel{+0.6}{-}0.3$, $\delta(723) = -3.2 \pm 0.2$, $\delta(1437) = 3.7 \stackrel{+2.7}{-2.0}$, $\delta(1489 = -3.3 \stackrel{+0.9}{-1.5})$

 $\delta(968) = -0.03 \begin{array}{l} -0.05 \\ +0.06 \end{array}$, $\delta(1368 = -0.045 \pm 0.090, \ \delta(1045) = 0.041 \begin{array}{l} +0.047 \\ -0.041, \ \delta(1691) = -0.02 \pm 0.01, \ \text{and} \ \delta(2091) = 0.00 \end{array}$

+0.02 -0.03. The first δ is M3/E2, the next three are E2/M1, and the last five are M2/E1. The retardation (a factor of approximately 50) of the crossover to cascade transitions from the 2039-keV, third 2- level to the second and first 2- levels is essentially the same for both the MI and E2 components. In addition, spin and parity assignment of 2+ were made for the 2039-and 2092-keV levels.

A Black Box Experiment. Philip J. Lorenz and Roger L. Far row, The University of The South. In the traditional general physics laboratory, students rarely have an opportunity to test hypotheses explicitly. In this exercise each student was provided with a metal can containing a simple mechanical system. His task was to fully describe its contents without opening, destructively testing or x-raying the can. A control can, i.e., a ground state system, was available. The techniques of a student in solving this problem are described.

ZOOLOGY SECTION GEORGE DAVIS SCIENCE, 100 H. MALCOLM OWEN, Chairman

The Chiroptera of West Tennessee. Michael J. Harvey and Frank F. Graves, Jr., Memphis State University and the University of Montana. Collection and observation over the past several years have verified the presence of 12 species of bats in West Tennessee, herein defined as the area, including all or part of 21 counties, between the Mississippi and Tennessee Rivers. Lasiurus borealis and Myotis austroriparius were found to be common throughout the area, although there is only one published record of M. austroriparius from the entire state (Grainger County). Also present, but less common and at scattered localities, were Myotis lucifugus, Myotis grisescens, Myotis keenii, Myotis sodalis, Lasionycteris noctivagans, Pipistrellus subflavus, Eptesicus fuscus, Lasiurus cinereus, Nycticeius humeralis, and Plecotus rafinesquii. Specimens were obtained primarily by mist-netting over ponds and watercourses, Caves and abandoned building in the area were also checked periodically for bats. Additional specimens were obtained from the Tennessee Department of Public Health, Several hundred individual bats have been banded with U. S. Fish and Wildlife Service bat bands and released. M. grisescens have been recovered as far away as 70 miles from the collection site.

A Kyphotic Eastern Spiny Softshell Turtle, Trionyx s. spinifer. James B. White and George G. Murphy, Middle Tennessee State University. A kyphotic adult female eastern spiny softshell turtle, Trionyx s. spinifer, was collected from the West Fork of the Stones River, Rutherford County, Tennessee, on 16 August 1971. The specimen weighed 2204 g. Measurements were as follows: plastron length, 19.5 cm; carapace (straight length) 25.6 cm; carapace (curved length) 32.6 cm; and height of apex of carapace above apex of pelvic bones, 6.0 cm. X-rays showed nine thoracic vertebrae rather than the typical ten, The fourth thoracic vertebra was abnormally long and arched. Fourth, fifth, and sixth pairs of ribs articulated with the anterior, middle, and posterior regions of the fourth thoracic vertebra. This abnormal rib articulation suggests a fusion of the fourth and fifth vertebrae. Muscles and visceral organs appeared normal and filled the cavity formed by the abnormal curvature of the carapace. The kyphotic conditions was probably the results of adnormal development of skeletal elements during embryonic development.

Morphological Variations in Three Populations of the Banded Sculpin, Cottus carolinae (Gil). James O. Sweeney, Jr., Middle Tennessee State University. Sculpins were collected by seining from the following locations in Tennessee: West Fork of Stones iver, Rutherford County (population A); Bashaw Creek, Coffee County (population B); and an unnamed spring in Lincoln County (population C). Average ray counts for the second dorsal fins of A (N=70), B (N=59), and C (N=75) were 17.17, 16.23, and 16.69, respectively. Average pectoral fin-ray counts for A, B, and C were 16.64, 15.83, and 15.88, respectively. Average anal fin-ray counts for A, B, and C were 13.07, 12.69, and 13.24, respectively. Average lateral line pore counts for A. B, and C were 33.48, 32.57, and 29.61, respectively. Total body length (mm) and weights (gm), respectively, of the largest sculpins taken were: 74 and 5.7 (A), 139 and 34 (B), and 139,48.4 (C). Vomerine and palatine dentition was poorly developed in A. Dentary and vomerine dentition was poorly developed in B. Variations in pigmentation and bands were observed. (This investigation is part of an in-progress thesis problem with the Biology Department, Middle Tennessee State

A Systematic Study of Ground Squirrels (Genus Spermophilis) by Serum Protein Electrophoresis. R. D. Ikenberry, East

Tennessee State University. Serum proteins of eight species representing five subgenera of ground squirrels were characterize by agar-gel electrophoresis. The serum protein patterns provided diagnostic features at the subgeneric, species group, species, and subspecies levels. Serum protein pattern similarity and difference indicated an arbitrary phylogeny. The subgenera Otospermophilus and Callospermophilus exhibited similar protein patterns. Otospermophilus was considered to exhibit the most generalized protein pattern. Callospermophilus exhibits specialization in the albumin and alpha globulin fractions. Ammospermophilus and Xerospermophilus differ from Callospermophilus in beta globulin characteristics. The subgenus Ictidomys shares characteristics of the other four subgenera and represents an intermediate group.

A Systematic Study of Six Genera of Squirrels by Serum Protein Electrophoresis. Jerry W. Wolfe and R. D. Ikenberry, East Tennessee State University. The serum of six genera of squirrels were characterized by agar-gel lectrophoresis. Species specific protein fractions were used as taxonomic characters. A phylogeny was constructed in the form of a dendrogram utilizing the sum of character state differences expressed as operational taxonomic units (OTU). The phylogenetic relationships that are implied by this procedure are as follows: Marmota exhibits a close relationship to Tamias; Glaucomys exhibits a relatively primitive state and close relationship to Tamais and Marmota; Sciurus represents the most advanced character state with Spermophilus and Tamiasciurus representing intermediate positions in the phylogeny.

Reproductive Behavior and Developmental Rates of the Wood Frog Rana Sylvatica. David Meeks, East Tennessee State University. This study reports on reproduction and development of Rana sylvatica near the souther limit of its distribution. Comparisons with equivalent studies in norther areas are made. mass is much lower in this southern form. There is a three month larval period. Eggs hatched twenty days after the first egg mass was observed. No overwintering in the larval stage was noted; metamorphosis was completed in June at body lengths ranging Breeding and egg laying activity is generally earlier in Tennessee and developmental periods longer. The number of eggs per from 17-19 mm.

Some Features of Incisor Tooth Development in Mice. Laurence R. Fitzgerald, University of Tennessee Medical Units. Early development of incisor teeth of mice shows several feature which are not well known. A very primitive tooth-like structure, apparently a deciduous incisor, is formed before the permanent incisor. This toothlet has no enamel and no roots. and never erupts. It is always present in the maxilla, but is variable in occurrence in the mandible. The incisal end of the permanent incisor resembles a single cusp of a molar tooth. having the typical depression forming the "enamel-free" area. Characteristic mammalian dentin is the fourth of a series of types of dentin which appear in the tip of this tooth. The other types resemble at least superficially, dentin which may be phylogenetically primitive. The portion of the incisor containing the unusual types of dentin is worn away within a few hours after eruption, leaving the familiar chisel-shaped incisal edge. lightly infected fish was 38.4 and the mean worm burden was 3.6.

A Comparison of the Effects of Light and eavy Infections of Posthodiplostomum Metacercariae (Trematoda, Diplostomatidae) on the Fecundity of Gambusia affinis affinis (Osteichthyes, Poeciliidae), Charles W. Holland, Female Gambusia of identical total length collected on the same day from one sample site were paired, with one member of the pair being classified as lightly infected and the other, heavily infected. In both light and heavy infections, 85 percent of the Posthodiplostomum metacercariae were found in the choroid and scleroid tissues. The remaining parasites were located in the loose ovarian connective tissue and occasionally attached to developing embryos. The fecundity of each member of a matched pair was entered as one observation into the appropriate infection group. The mean fecundity of The mean fecundity of heavily infested fish was 37.2 and the mean worm burden was 12.2. At 476 degrees freedom a t-test, t(.05), indicated no differences in mean fecundities.

Microhabitat and Competitive Exclusion in the Genus Desmognathus, J. W. Nagel, East Tennessee State Univ. Field studies on the dusky salamander (Desmognathus fuscus) and the seal salamander (D. monticola) in upper East Tennessee indicate that at lower elevations the two species coexist within

the banks of small mountain streams. In this situation D. fuscus recommend or simum measurems areass, in this sension of passess to recommend and an areas of the comment of the or essenancy aquaince and an monocous exemples use more unland unland portions of the stream bed and stream banks. At highunantee persons of the stream new and stream comes, AL regi-er elevations D, monticella is absent and D, function occupies both the aguatic and seminerestrial microhabitate of the stream chanone assume and sentinerrestrial interpretations of use stream control. These distribution patterns suggest that in areas of couns. Lucse assiruanten panerus suggest mat in areas of co-necessarie D. funts is competitively excluded from the semiinterested on passer is compensately excused from the semi-terrested microbabilist by D. monticula. Other investigators have suggested that D, factor is an ecological generalist: this

Plummints of Tennessee, C. M. Chandler, Middle Tennessee study adds further support to their hypothesis. State University, J. T. Darlington, Southwestern at Memphis, A state unite survey was conducted intermittently from 1966 to 1977 and indicated three families of Tricladida comprising nine species. Of the Planaridae Cura forenamic occurred at 15 sites and Dupenia donnocephala was collected from 10 sites, both species being essentially throughout the state. Dogesta tigrina and Phageons gracilis were taken from 11 and 10 sites, respecifiedy, primarily in western and middle Tennessee. Phagocata margani was found at 18 sites mostly in eastern Tennessee. Phagocata velata was collected from 3 sites in middle Tennessee only, and Phagocane vermalis occurred only in western Tennessee at one site. Of the Dendroccelidae Procetyle flavianilis was observed only at 2 sites, both in western Tennessee. Spophila has brichi (Kenkiidae) was found in a stream issuing from a cave

Ranges of temperature, distribution, associations of species, descriptions of habitats, and records of other investigators are

Postuttul Bone Development in the Mongolium gerbil, Merones unquiredanas (Mammalia, Rodentia) [I. Denise L Pav and Albert F. Munon, Jr., East Tennessee State University. Pay and McKee (1971) described the emergence and closure of the emphysical planes during postnatal development of long bones in the Mongoliun gerbil (Meriones unquiculants). A re-examination of the plausible explanation for the persistence of epiphyseal planes in adults of this species. Radiograms and histological secnons of decalcified bone obtained from animals ranging in age from newborn to three years, eleven months were studied.

An apparent increase in trabecular bone production in the area of the epiphyseal plate was found to occur in the distal portion of the femor in sexually mature gerbils. In adulthood, reacrangement of home appears to result in isolating the epiphyseal plate thereby forcing it into documency.

A Preliminary Report on the Systematic Reevaluation of the Genus Leinburum (Arachmida: Phalangida). Charles R. McGhee, Middle Tennessee State University. A systematic study of the genus Leinburum was conducted to determine stable criteria for the evaluation of species. Numerous specimens from the southern Appulachian Mountains and The American Museum of Natural History collections were examined in addition to available type material. The investigation resulted in the recognition of a number of sub-generic sections and groups and adds considerably to an understanding of the taxonomy of the genus. Unlikesion of the penes and male pedipulps as primary taxonomic characters demonstrates manifest affinities within species groups. This paper considers the criteria which have been utilined in the revision of the genus. No attempt is made at this time to include descriptions of the species upon which the reevaluation is based. Species descriptions will be included in subsequent papers dealing specifically with sub-generic di-

DDT retention to Cellular Fractions of Vertebrate Insecticideresistant and Succeptible Tistues. Marion R. Wells and James D. Yarbrough, Middle Tennessee State University and Mississippi State University. DDT-resistant and susceptible populations of mosquitafish (Gambasia affinis) were assayed for DDT retention to particulate fractions of livers and brains following in vivo and invitre treatment with DDT-C14. The invite studies indicate a significant difference in DDT uptake between susceptible and resistant fish brains and point to a membrane barrier as well as a more effective blood-brain barrier in resistant fish.

The Drug Scene in Man and Other Animals. John M. Mallette, Tennessee State University. As a follow up to some earlier work done with tranquilizers, Alcohol and other drugs in Chick Embeyos and Pregnant Rats we became interested in how our data correlates with data obtained from other investigators and how it might be directly related to the current drug scene in

man. The strongest and perhaps most shocking finding is that man.
the peer culture among young addicted indicate that the peer culture among young addicted indicate that the peer culture among young addicted indicate that the peer culture by the peer culture among young the peer the particle of the particle o are compelled to contain any concepts for are mendations will be made concerning new concepts for attitude well as interactions of all living organisms mendations will as interactions of all living organisme

COLLEGIATE DIVISION SATURDAY, NOVEMBER 20, 9:00 A.M. GEORGE DAVIS SCIENCE, 100 RICHARD J. RARIDON, Chairman

Assorption and Flame Emission - A Laboratory E. W. Rankin, Memphis State University Th. Anomic Absorption and Anomic emission spectroscopy Et. perjunent. Ben w. raman atomic emission spectroscopy will be ciples of absorption and atomic emission spectroscopy will be ciples of absorption and experiment which demonstrates but described together with an experiment includes analyses of the described together with an experiment includes analyses of the experiment includes analyses of the described together with a second or the experiment of the experiment includes analyses of the experiment includes analyses of the experiment of the exp described together with an experiment includes analyses of menus of these techniques. The experiment includes analyses of menus of these techniques. In additional importance. In additional includes analyses of the experiment includes analyses of of these techniques. In of ecological importance, In addition and cadimum in Samper and of the relative sensitivities of a comparison has been made of the relative sensitivities of a comparison has occur and emission in the analysis of aluminum anomic absorption and emission in the analysis of aluminum.

The effects of an oxygen-acetylene versus a nitrous oxide-acty-The effects of the atomic absorption of aluminum were also: vestigated.

estigated.

Investigation of the Sensitivity of the Hands of Sightless Per-Investigation of the Infra-red Radiation for Shape and Leng-sons to Low-Level Infra-red Radiation for Shape and Leng-na-hora Brock. University of Tennassan gons to Low-Levis Brock, University of Tennessee at China. Recognition. But our radiation. This investigation is a series of heat or infra-red radiation. This investigation is a series of to heat or materiments attempting to determine the limits and preliminary experiments of this sensitivity. To date, the experiment of the applications of this sensitivity. To date, the experiments of the expe some of the approximated to totally sightless people. The caperments have been performed by heating black paper objects or he ments have occurred projector. The subjects then try to identitiers with an occurrence by sensing the emitted infra-red radiation the heated series by a few inches above them. All subjects with their hands held a few inches above them. All subjects usth their appear able to correctly identify letters and real tested so I are appeared in the same approximately one inch in height short words with a negle with 3/16 inch wide lines. This sensitivity has appeared to be with 3/10 man with 3/10 me tested to one degree or another. The ultimate resolution capability of this sense is yet to be determined

The Short Period Eclipsing Binary Star ZZ Cygni, Richard o. Cannon, III and Douglas S. Hall, Dyer Observatory, Vandehilt University. A complete photoelectric light curve in the colors (UBV) was obtained for the short period (P-WG) eclipsing binary star ZZ Cygni. A faint visual companion had to be included in the photometry. There were intrinsic lide variations (±5%), apparently irregular. After the removal the visual companion's light, the light curve was recified for ellipticity and reflection and solved for the elements in the tund way. The color indices implied the hot star was of spectral tree B7 (heavily reddened) or F7. This was in conflict with a previously published A: classification but in perfect agreeness with an F8:V classification obtained recently at our request in Humphreys. The relative eclipse depths then show the other star to be very cool, of spectral type K3(IV). If the hot sur has a mass and radius normal for main-sequence stars, the fellowing absolute dimensions result: 1.2 M. and 1.3 R. for the hot star; 0.6 M. and 1.2 R. for the cool star; and the coil sur fills its Roche lobe. Although ZZ Cygni is most probably m Algol-like binary (a remnant of evolutionary mass exchange in a close system), the hot star is quite cool and quite low in man. In these two respects it is similar to the Algol-like binuits XI Andromedae and RT Persei, respectively. This research was supported in part by National Science Foundation Resents Grant GP-19895

Simple Holographic Interferometry. James M. Monte, Mildle Tennessee State University. Real time holo-interferunce may be used to measure small changes in position and size of a solid object with a great deal of accuracy. For example by making a hologram of a solid object, in this case an aluminum plate, an reconstructing the image produced by the hologram in the same place as the original object, one can measure the mpansion due to heating. The rays from the reconstructed imp and the thermally expanded object interfere wherever they our lap because of optical path difference and produce interleute fringes. It is by analyzing these fringes that one may plat the changes in position of any point on the surface of the shipt.

The Kinetics and Energy of Activation of the Esterification of Acetic Acid and Ethanol in the Presence of Sulfuric Acid. Gary F Carnahan, David Lipscomb College. The Fischer esterification reaction has long been held important by physical organic chemreaction is use by Guldberg and Waage in 1897 to develon the law of mass action. A study was made of the reaction of the saw of the reaction of glacial acetic acid and absolute ethanol in the presence of sulfuric acid which produces ethyl acetate and water. This reaction

was shown to follow second order kinetics. The technique used to follow the progress of the reaction was to determine the decreasing area of the quartet due to the methylene protons of ethanol in the nmr spectrum at varying times. The application of the Arrhenium equation to the second order rate constants and the temperatures at which these were detremined allowd the calculation of the energy of activation for the esterification as 7.22 kcal/mole.

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Abstracts of Papers Presented at the Annual Meeting

THE RELATIONSHIP OF EARTHWORM (OLIGOCHAETA: ACANTHODRILIDAE AND LUMBRICIDAE) DISTRIBUTION AND BIOMASS IN SIX HETEROGENEOUS WOODLOT SITES IN TIPPECANOE COUNTY, INDIANA.

JOHN WARREN REYNOLDS The University of Tennessee Knoxville, Tennessee 37916

ABSTRACT

Observations on earthworm populations have been made in Tippecanoe County, Indiana to determine the distribution, species complex, population density and biomass estimates in six woodlots under different ecological conditions. The survey shows that six species are present, representing five genera. All six species have been previously recorded in other areas of Indiana.

The maximum number of species occurring in any single woodlot population was four, two being the more usual. In 1968 there was Lumbricus terrestris in combinations with Bimastos zeteki, Dendrobaena octaedra, and Octolasion tyrtaeum.

The relative abundance and biomass of earthworms annear to decrease with a decrease in soil moisture, soil acidity, and palatability of the food source. The elm and maple species being the more palatable while oak and beech species the less

The equations determined for dry weight and wet weight to length of earthworms are: log D = 0.4055 + 2.3900 log L and log W =0.2800 + 2.3362 log L where L = earthworm length in cm, D = dry weight in mg, and W = wet weight in mg. The correlation coefficient for both of these equations is 0.91.

Earthworm densities ranged from a minimum of 14.2 to 142.4 per m2. The range of wet weight biomass estimates were 26.29 to 280.28 g/m³. The maximum biomass value was > 100% of the values reported in American and European literature for comparable ecosystems.

INTRODUCTION

This study was undertaken to determine the earthworms present in six heterogeneous woodlot sites during the summers of 1967 and 1968. These sites have been utilized by other researchers in the Entomology Department at Purdue University and yielded considerable ecological data. This study is the first attempt to evaluate oligochaete information from these woodlots.

For more than a half century, distribution records for Indiana have been published. In 1914, Heimburger published the first regional paper on the earthworm fauna of Indiana. His preliminary list of 14 species included Bimastos (Helodrilus) zeteki Smith and Gittins 1915, Diplocardia singularis Ude, 1893, and Octolasium lacteum (Örley, 1881) which is a synonym for Octolasion tyrtaeum (Savigny, 1826) (Gates, personal communication). This error has gone unchecked for decades resulting in frequent Octolasium lacteum citations incorrectly appearing in the literature. Smith (1917) added the 15th species. Gates (1942) increased

the state list to 16 species. Then Chandler (1953) added ten species to bring the total to 26, including Dendrobaena octaedra (Savigny, 1826), Lumbricus rubellus Hoffmeister, 1843, and Lumbricus terrestris L. Finally Joyner (1959) listed two additional species to the state list and verified four of Chandler's records, including D. octaedra, L. rubellus, and L. terrestris.

Edwards (1967) found that the expression of soil animal populations as biomass is more meaningful than numbers; this is particularly true when considering the productivity of a habitat. Biomass values reported in the literature are confusing because rarely, if ever, is it stated whether they are wet or dry weights. To illustrate, Bornebusch (1930) stated "the earthworms collected were sorted according to species, counted, and weighed." After reviewing the original European papers, I assumed that Bornebusch's values and those summarized by Satchell (1967) are wet weights.

Water ordinarily constitutes 80-90% of the living earthworm's weight (Grant, 1955), although earthworms possess a remarkable ability to withstand desiccation of 70% or more of their water content (Roots, 1956). Therefore, only dry weight biomass estimates should be used in comparing the productivity of earthworm populations from different habitats.

SITE CHARACTERISTICS

The sampling sites were selected to provide a number of clear-cut seres in a deciduous forest succession and several physiographic soil types. The soil pH values were 1:1 KC1 determinations. The vegetative classes were; seedlings-less than 2.5 cm dbb, soplings-2.5 to 10.2 cm dbb, and trees-greater than 10.2 cm dbh. The sites were 0.08 hectare circles of 15 meter radius.

This site was on the flood plain of the Wahash River bordering the Purdue University Veterinary Farm. The soil of this moderately well drained bottomland is an Eel silty clay learn. 0 to 3% slope. These soils were developed from neutral to slightly calcareous alluvium from timbered glacial drift. The Eel series is a member of a fine-loamy, mixed, mesic family of Aquic Fluventic Eutrochrepts. The pH of the upper profile was 6.7 with an 02 horizon of approximately 0.6 cm. The dominant tree species are silver maple (Acer saccharinum L.) and Cottonwood (Pondus deltoides Bartr.). In approximately a 2:1 ratio