

ABSTRACTS PRESENTED AT THE ANNUAL MEETING

GENERAL SESSION

Friday November 16, 10:00 A.M.

Stevenson Center, Room 4309

J. Gerald Parchment, *Chairman*

WELCOME: Nicholas Hobbs, *Provost*
Vanderbilt University

Waste Heat Management: Problems and Methods of Control. Barry A. Benedict, Vanderbilt University (20 min.)

Simulation of the Energy Environment System. L. K. Akers, Chairman, Special Training Division, Oak Ridge Associated Universities (20 min.)

A Collection of 19th Century Scientific Apparatus. Robert T. Lagemann, Vanderbilt University (20 min.)

Vertebrate Fossils of Tennessee. James X. Corgan, Tennessee Division of Geology and Austin Peay State University (20 min.)

Learning Modules: A Versatile Teaching Tool. Hugh F. Keedy, Vanderbilt University (10 min.)

Institutionalizing Change: A Modest Proposal. R. S. Goodrich, Vanderbilt University (10 min.)

Waste Heat Management: Problems and Methods of Control. Barry A. Benedict, Vanderbilt University. Problems associated with the disposal of waste heat from the process of generation of electric power have become a topic of major concern within the last few years. A number of methods for managing this heat disposal problem are discussed, including once-through discharges to a receiving body of water; cooling towers, both wet and dry; cooling ponds with and without spray modules; and possible beneficial uses for the waste heat. Technical capabilities and limitations of each process are indicated along with economic considerations.

The potential of each control method for damage in various areas is presented, including these: effects of the heat on the ecosystem, increase of fogging, effect of chemical blowdown on ecosystem, increased evaporation losses, land use policies, and aesthetics. The waste heat management scheme proposed for any given power plant should be based on the conditions existing at that plant.

Energy-Environment Workshops. L. K. Akers, Oak Ridge Associated Universities. A new program of the Atomic Energy Commission is designed to carry information about the energy crisis and its environmental impacts to citizens in metropolitan areas throughout the U. S. An "Energy-Environment Simulator," a 21 variable analog computer which simulates the energy resource demand situation for the United States and the world, has been constructed to illustrate the interrelationship of energy supplies, demands, and effects. The materials used in the Citizens' Workshop program will be described and the simulator will be demonstrated.

A Collection of 19th Century Physics Apparatus. Robert T. Lagemann, Vanderbilt University. The collection to be described represents the demonstration apparatus that a knowledgeable, experienced teacher thought was needed to teach the usual introductory physics course in an American college a hundred years ago. All the pieces, some 250 in number, were purchased at the same time (1875) from such European makers as Deleuil, Duboscq, and Koenig of France, Elliott and Casella of England, and Ertel and Merz of Germany. About ninety-five percent of the original apparatus is still intact and has been cleaned, repaired, cataloged, and placed on exhibition at Vanderbilt University. Slides of representative pieces will be shown, and a few items will be displayed. The sources of the apparatus in the designs of the earlier craftsmen, 's Gravesande and van Muschenbrock of Holland, for example, will be discussed.

Vertebrate Fossils of Tennessee. James X. Corgan, Tennessee Division of Geology and Austin Peay State University. Vertebrate fossils have been collected from 99 different localities within Tennessee. They range in age from about 360,000,000 years before present to species that become extinct about 8,000 years ago. Thirty-nine of the ninety-five counties in the state have at least one vertebrate locality and Davidson County has ten. Of the 99 known localities, 69 are described in the literature and 30 are here recorded for the first time. Thirteen localities are of Paleozoic or Mesozoic age and the remaining 86 localities are Pleistocene. Detailed study of this large group of Pleistocene (Ice Age) localities could provide insight into the historical development of the modern vertebrate fauna. A series of 14 maps shown the geographic distribution of Pleistocene and pre-Pleistocene vertebrates. Color slides illustrate typical fossils.

Learning Modules: A Versatile Teaching Tool. Hugh F. Keedy, Vanderbilt University Engineering School. Educators are increasingly faced with the problem of making the teaching/learning process more efficient. One way by which efficiency can be improved is by giving instruction only in what is needed by the student. This is difficult in a classroom situation where abilities and backgrounds are widely diverse. The typical procedure in such cases is to somehow try to optimize by covering the material most needed by most students. The obvious problem with this approach is that some (possibly essential) material is not made a part of the understanding of some students. This paper proposes some uses of learning packages, or modules, which may be developed and used to increase teaching/learning efficiency in varied situations. Suggested uses will range from applications in remedial cases to enrichment materials suited to diverse interests.

Institutionalizing Change: A Modest Proposal. R. S. Goodrich, Vanderbilt University. The rapidity of technological change and its societal consequences have rendered obsolete our traditional mechanisms of renewal and reform. We must change our mode of change and begin to seek and apply processes that lead to a dynamic stability. In the past few years, vast improvements in forecasting and dynamic modeling techniques indicate that a first approximation to a systematic "science of change" is now available. The methodologies associated with these techniques are generally found in the new field of Futures Research.

This paper will discuss some of the problems associated with developing a model of change. Three basic components of the model should be:

- trend analyses of the recent course of events to determine the most probable future states,
 - the evaluation of these most probable future states based on the normative processes of change, and
 - the design of strategies to implement the desired states.
- The use of technological indicators, social indicators, and international affairs indicators in Futures Research will be discussed.

SECTIONAL MEETINGS FRIDAY, NOVEMBER 16

BOTANY

JAMES T. MURRELL, *Chairman*

BOTANY SECTION I CALHOUN HALL, 320

JAMES T. MURRELL, *Chairman*

The Chlorophyll and Soluble Protein Content of Cinnamon Fern Leaves During Growth and Ageing, James D. Caponetti, The University of Tennessee, Knoxville (15 min.)

Some Factor Related to Bud-Scale Formation in Cinnamon Fern. Gordon Morris and James D. Caponetti, The University of Tennessee, Knoxville (12 min.)

Spore Studies of the Fern Genus *Asplenium* Using Scanning Electron Microscopy. Ronald W. Pearman, The University of Tennessee, Knoxville (10 min.)

Scanning Electron Microscope Investigation of the Spore of the Coastal Plain *Lycopodium* (Lycopodiaceae), Jerry C. Odenwelder, The University of Tennessee, Knoxville (10 min.)

The Anthocyanin Pigments of Sessile-Flowered *Trillium* (Liliaceae). Sandra S. Asbury and James T. Murrell, George Peabody College (10 min.)
Intermission (10 min.)

Flavonoid Studies in *Persea* (Lauraceae). Eugene Wofford The University of Tennessee, Knoxville (10 min.)

Nitrogenase Activity by "Waterbloom": Forming Blue-Green Algae Under Fixed Illumination. J. T. Wyatt and D. N. Rinehart, East Tennessee State University (15 min.)

A Limnological Investigation of Ten Axenic Strains of the Family Rivulariaceae. D. N. Rinehart and J. T. Wyatt East Tennessee State University (15 min.)

The Chlorophyll and Soluble Protein Content of Cinnamon Fern Leaves During Growth and Ageing. James D. Caponetti, University of Tennessee. Studies on isoenzyme patterns in cinnamon fern leaves in connection with problems of leaf determination and differentiation have led to concurrent studies on ageing. During development in higher plants, the various stages of growth and differentiation are known to be accompanied by changes in both complement and content of soluble proteins. Since cinnamon fern leaves are so amenable to sterile tissue culture, it became evident that these leaves offer an excellent system for the study of ageing. Soluble protein levels fluctuated during the several stages of growth and differentiation showing that enzymes are more active at certain stages of leaf development and less active at other stages. A concomitant monitoring of chlorophyll showed that total chlorophyll content steadily increases during the growth phase and then decreases during senescence.

Some Factors Related to Bud-Scale Formation in Cinnamon Fern. Gordon Morris and James D. Caponetti, University of Tennessee. Determination of factors relating to bud-scale formation in cinnamon fern was undertaken. Leaf primordia were cultured on an agar medium including mineral salts and various concentrations of growth regulators (indoleacetic acid, and various adenine, gibberellic acid, both singly and in combination, and in conjunction with variable sucrose concentrations and light-

temperature regimes. Gibberellic acid ($10^{-4}M$) and adenine ($10^{-4}M$) showed the maximum stimulation of growth. Adenine caused leaves to mature early. Both kinetin and indoleacetic acid caused alteration of leaf morphology. Kinetin caused pinnae to be more crowded toward the leaf apex, and more divided. Indoleacetic acid ($10^{-4}M$) treatment seemed to approach a simulation of bud-scale formation in culture. Combinations of the growth regulators tended to override the effects of the indoleacetic acid ($10^{-4}M$).

Spore Studies of the Fern Genus Asplenium Using Scanning Electron Microscopy. Ronald W. Pearman, University of Tennessee. The genus *Asplenium* is a classic example of reticulate evolution involving hybrid crossing and backcrossing. *Asplenium platyneuron*, *A. montanum* and *A. rhizophyllum*, which occurs in the Southern Appalachian region, are the parental species from which several taxa of hybrid origin have been formed. This investigation relates spore architecture to hybridity within this complex. Discussion will relate to differences in spore morphology among the taxa as presented by the fine detail made possible by the SEM.

Scanning Electron Microscope Investigation of the Spores of the Coastal Plain Lycopodium (Lycopodiaceae). University of Tennessee Knoxville. A lack of understanding of population structure within the Coastal Plain *Lycopodium alopecuroides* complex has caused continuous confusion among taxonomists for many years. As a result, some workers have recognized three variable taxa, others four variable taxa, and still others three or four distinct taxa with variability resulting from hybridization.

The Scanning Electron Microscope has been utilized in the present study of *Lycopodium* spores as a tool for distinguishing among taxa and their putative hybrids within populations. Ultimately, SEM data, along with other comprehensive taxonomic information, should be valuable in determining the population structure, and therefore the taxonomy, of *Lycopodium*.

The Anthocyanin Pigments of Sessile-Flowered Trillium (Liliaceae). Sandra S. Asbury and James T. Murrell, George Peabody College. Chromatographic and spectrophotometric methods were used to investigate floral anthocyanins occurring in sessile-flowered species of genus *Trillium* L. (Liliaceae). An anthocyanin isolated from the purple and magenta petals of samples of *T. sessile* L., *T. cuneatum* Raf., and *T. stamineum* Harb. was identified as cyanidin-3-O-diarabinoside. Both the natural forms of this pigment and its hydrolytic products, an anthocyanidin moiety and sugar residues, were analyzed. This pigment appears to be unique in the sense that its sugar component, a disaccharide component of all of the known cyanidin-3-biosides is composed of at least one molecule of glucose or galactose and a pentose, if present, other than arabinose.

Flavonoid studies in Persea (Lauraceae). Eugene Wofford, University of Tennessee. Flavonoid compounds were isolated and identified as part of a recent biosystematic study of the southeastern U. S. taxa of *Persea*. *Persea borbonica*, *P. humilis*, and *P. palustris* can be separated on the basis of their chromatographic profiles while *P. littoralis* was found to be chromatographically identical to *P. borbonica*. Other biosystematic data also indicate that *P. littoralis* is conspecific with *P. borbonica*. Of the 12 compounds identified, 10 have not been previously reported for the genus.

Nitrogenase Activity by "Waterbloom"—Forming Blue-Green Algae under Fixed Illumination. J. T. Wyatt and D. N. Rinehart, East Tennessee State University. With our working assumption being that most blue-green algal waterblooms are directly related to effectual nitrogen fixation, we have examined nitrogenase activity in about 20 strains of gas-vacuolate cyanobacteria. At $1 \text{ mg cells} \times \text{ml}^{-3}$, there is a wide range of optical densities (about $.070$ — $.380$ at 420 nm) between strains. Under approximately 300 ft. candle illumination, those forms with greatest optical densities, i.e., lower light-utilization efficiencies, generally have highest nitrogenase activity rates at cellular concentrations $< .05 \text{ mg cells} \times \text{ml}^{-3}$. However, less opaque strains may exhibit maximum rates at cellular concentrations approaching $1 \text{ mg cells} \times \text{ml}^{-3}$. Neither individual cell size nor filament length appear to be critical in light-use efficiency. Also, we have not been able to establish that smaller cells generally have highest nitrogenase

activities nor that normal laboratory growth-rate is positively correlated with nitrogenase activity. Probably, under favorable conditions, blue-green algal nitrogen-fixing systems usually provide ample ammonia for unrestricted growth.

A Limnological Investigation of Ten Axenic Strains of the Family Rivulariaceae. D. N. Rinehart and J. T. Wyatt, East Tennessee State University. Blue-green algae of the Family Rivulariaceae can be easily recognized by the tapering of their trichomes, the major characteristic of the group. However, it is very difficult to make generic assignments of these organisms in axenic cultures by using traditional methods. This problem is reflected by the recent questioning of the validity of the genus *Rivularia* which differs from *Gloeotrichia* only by the former's lack of spores. Ten axenic strains of Rivulariaceae were studied morphologically and physiologically in an attempt to better categorize the members of this group. Only those morphological features (spores, intercalary heterocysts, attenuation) that remained constant in axenic culture were considered for the first criterion. The physiological traits measured were the ability to grow heterotrophically in darkness, aerobic nitrogenase activity, and approximate rates of photosynthesis. Under several different conditions, heterotrophic growth was minimal for all the organisms. Acetylene reduction rates averaged about $3.0 \text{ n moles } C_2H_4 \times \text{mg cells}^{-1} \times \text{min}^{-1}$. Photosynthetic rates were likewise low in most cases. Consequently, this algal group may be ecologically competitive only under very special conditions.

BOTANY SECTION II

BUTTRICK HALL, 114

R. B. CHANNELL, *Chairman*

An Ecological Survey of Filicinae on a Selected Portion of River Ridge, Norris Tailwaters, Tennessee. Joel G. Zachry, Roane State Community College (20 min.)

Tree Species Diversity in a Virgin Harwood Forest. William H. Martin, Eastern Kentucky University (15 min.)

Cedar Glades of Tennessee—an Endangered Ecosystem. Elsie Quarterman, Vanderbilt University (15 min.)
Intermission (10 min.)

An Atlas of the Vascular Flora of Tennessee. A. M. Evans, B. E. Wofford and R. W. Pearman, The University of Tennessee, Knoxville (10 min.)

Acquisition of A Natural Area. Harris O. Yates, David Lipscomb College and Elsie Quarterman, Vanderbilt University (10 min.)

Cladistics of *Pentachaeta* (Asteraceae: Compositae). Gene S. Van Horn, The University of Tennessee, Chattanooga (10 min.)

The Photograph as a Document. Allison von Slagle, The University of Tennessee, Chattanooga (20 min.)

Election of Section Officers for 1974, Buttrick Hall, 114.
An Ecological Survey of Filicinae on a Selected Portion of River Ridge, Norris Tailwaters, Tennessee. Joel G. Zachry, Roane State Community College. An ecological survey of Filicinae was conducted on River Ridge, located in Anderson County, Tennessee. The mile and one-half ridge is parallel to and borders on its west, the Clinch River tailwaters of Norris Dam. A quarter mile portion along the south-western slope was surveyed. The general physical characteristics of the area were noted on field trips. Specific topographical data, climatological data, and soil information were compiled from various governmental sources. Collections were made from May through August, 1973, to determine the taxa present and their relative habitat patterns.

The survey revealed a diversity of habitats within the perimeter of the slope. Identification from field collections indicated

seven taxa present. Specimens were classified according to *A Field Guide to the Ferns*, Cobb (1963), and confirmed by Dr. A. M. Evans, Herbarium, University of Tennessee, Knoxville. Some taxa were noted to exist in all of the habitats while others appeared only sparsely scattered in one area. Observations indicate the varying range of habitats accounts for the number of taxa found.

Tree Species Diversity in Virgin Hardwood Forest. William H. Martin, Eastern Kentucky University. A contemporary measurement used in quantifying ecosystem stability is a determination of species diversity. Generally, habitats with relatively high diversity are considered the most stable and least likely to be adversely affected by disturbances such as disease or periods of weather extremes. In addition to counting taxa, several indexes measure diversity by including taxa and a determination of their contribution to ecosystem structure and function.

Tree species diversity has been determined in upland virgin forest in southeastern Kentucky and results indicate variation in diversity among several, stable plant communities. Based on the Shannon-Wiener index, diversity increases from communities dominated by *Tsuga canadensis*, *Fagus grandifolia*, or oak taxa to mixed mesophytic forest. The value for the entire forest is greater than previously reported from the region. These results should be useful in comparison of diversity and stability in other segments of eastern deciduous forest.

Cedar Glades of Tennessee—an Endangered Ecosystem. Elsie Quarterman, Vanderbilt University. Dams and "development" on private and public land threaten the continued existence of the cedar glade ecosystem. Fifteen or more endemic plant species and an undetermined number of animal species, offer many educational and research opportunities, provided tracts of land large enough to accommodate the sporadic distribution of species and resulting diversity can be preserved. The best hope for this lies in the Natural Areas program of the State.

An Atlas of the Vascular Flora of Tennessee. A. M. Evans, B. E. Wofford, R. W. Pearman, The University of Tennessee, Knoxville. We are assembling a distributional atlas of the vascular plant flora of the state. This will make available to interested individuals and agencies the current state of knowledge of our flora and point out weaknesses in current information as a guide to future studies. We are presently remapping our own collections and bringing our taxonomic and nomenclatural concepts up-to-date through correlation with other appropriate regional manuals and recent monographs. Plans are to visit all herbaria in the state to insure completeness of the final product. While this project sounds like a monumental cataloguing operation (which it is), it is also a challenging and demanding way to examine our total flora with its range of variability from the peaks of the Appalachians to the coastal plain. Out of this project is coming a continual flow of intriguing questions and research potential, which is one of our primary rewards.

The Acquisition of a Natural Area. Harris O. Yates, David Lipscomb College and Elsie Quarterman, Vanderbilt University. Two years of intensive effort, initiated by biologists in the Nashville area, culminated in the purchase of the Radnor Lake Area, the first of Tennessee's Class II Natural Areas to be acquired by the state. Private citizens, local, state and federal agencies contributed funds to preserve the 80-acre lake and 750 acres of wild land surrounding it. The tract, located in the edge of Metropolitan Nashville, offers great diversity in habitat, flora and fauna, and thus a limitless educational opportunity. Biologists are well qualified to recognize and help preserve other such areas across the state.

Cladistics of Pentachaeta (Asteraceae: Compositae). Gene S. Van Horn, University of Tennessee at Chattanooga. Twenty characters of *Pentachaeta* were treated by the Wagner method to construct a phylogenetic tree. The related group criterion was employed to determine the relative advancement of each character state. The character correlation is 86%.

The data yielded several possible phylogenetic trees, all very similar. The root of the tree in each case is among the entomophilous taxa and the three most advanced taxa are autogamous or anemophilous. *Pentachaeta* apparently originated in the region of southern California and then spread in a northerly direction.

The Photograph as a Document. A. von Slagle, University of Tennessee at Chattanooga. This study grew from an investigation of the various types of photographic technologies that might be used to document by visual rather than verbal forms the collections of flora gathered on field trips. It is primarily a probe of photo method as means to reach the final objective; accurate documentation. This method is proposed as a complement to the usual written notes and drawings.

The visual realism of this macrophotographic, photogram method is planned with the contention that as the amount of photographic detail is increased, communication of scientific findings are also increased.

Several cameras of the single lens reflex were used and proved to be of approximately equal value for the macrophotographic documentation. The lenses varied from 50mm to 135mm focal length and were used in combination with extension tubes and bellows attachments.

Optical definition was best with the use of 160 to 400 ASA speed film with the resulting ability to use a smaller aperture and a higher shutter speed. The smaller iris aperture also improves depth-of-field, so important in most macro photographs.

CHEMISTRY SECTION

STEVENSON, 5306

ROBERT T. SWINDELL, *Chairman*

Intermolecular Potentials from Molecular Crystals. Frank A. Momany, Memphis State University (10 min.)

Denaturation of Alpha Amylase by Urea. J. M. Wakim and H. McClanahan, The University of Tennessee, Martin (15 min.)

Liquid Carbon Dioxide as a Solvent for Optical Absorption Studies. R. L. Hoffman and C. C. Thompson, Memphis State University (15 min.)

Thermodynamic Properties of Bimolecular and Termolecular Complexes of Tetracyanoethylene. Eugene Yu-Kit Ho and C. C. Thompson, Memphis State University (15 min.)

Hydrolysis of some Aromatic Anhydrides in the Presence of Cycloheptamylose: Kinetics of Intermediate Ester Hydrolysis. R. L. Shankle, C. E. Harding, and C. R. Wasmuth, The University of Tennessee, Martin (12 min.)

Preparation of Elemental Isotopic Material for Targets. J. O. Younghane, E. W. McDaniel, and H. H. Caudill, Oak Ridge National Laboratory (20 min.)

Election of Section Officers for 1974.

Intermolecular Potentials From Molecular Crystals. F. A. Momany, Memphis State University. From an examination of more than forty molecular crystals, including hydrocarbons, amides, carboxylic acids, and aminoacids, an internally consistent set of atom-atom interaction potentials was obtained. The total potential correctly predicts the crystal lattice packing arrangements and the binding energies of these crystals. The potential includes contributions from dispersion, electrostatic, and hydrogen-bonding terms. It appears that this set of intermolecular potential energy functions will be applicable to the prediction of the packing configuration of most molecular crystals, and its use in calculating molecular conformations of biologically interesting molecules is being developed.

Denaturation of Alpha Amylase by Urea. Jubran M. Wakim and Hugh McClanahan, University of Tennessee at Martin. Alpha amylase from *B. subtilis* loses biological activity in the presence of urea. The loss of activity increases with increasing concentration of urea and reaches 100% at approximately 4 M urea. The denaturation of the enzyme by urea may be repre-

sented by the following mechanism, Native step 1 Denatured I step 2 Denatured II.

In step 1, the denatured enzyme regains some of its activity upon the removal of urea from the medium. The extent of activity recovered depends on the incubation period of the enzyme with urea. Also, this step does not appear to be influenced by the H⁺ concentration in the pH range of 4.0-8.5.

Step 2 leads to irreversible denaturation which follows 1st order kinetics even when little activity is left. The rate of denaturation is sensitive to urea concentration, pH and temperature.

The changes in the structure of the enzyme that produce the different denatured forms are presently under investigation.

Liquid Carbon Dioxide as a Solvent for Optical Absorption Studies. R. L. Hoffman and C. C. Thompson, Memphis State University. The use of liquid carbon dioxide as a solvent for infrared, visible, and near ultraviolet absorption measurements near room temperature presents several problems not normally encountered with conventional solvents. A high pressure absorption cell of Monel metal with quartz windows has been constructed for use with a Cary 14 spectrophotometer. The cell is equipped with temperature control and temperature monitoring accessories. Sample handling techniques and special problems such as removal of trace amounts of water from the solvent will be discussed together with the results of absorption studies of molecular iodine in liquid CO₂ and CO₂-organic solvent mixtures at wavelengths between 300 and 2400 nm.

Thermodynamic Properties of Bimolecular and Termolecular Complexes of Tetracyanoethylene. C. C. Thompson and Y. E. Ho, Memphis State University. Optical absorption data for mixtures of tetracyanoethylene with benzene, toluene, p-xylene or mesitylene in heptane have been interpreted in terms of a bimolecular (AD) and termolecular (AD₂) complex model. A computer search technique was used to evaluate association constants and molar absorptivities for AD and AD₂ at temperatures between -20 and 50°C. Free energies, enthalpies, and entropies of interaction were then calculated by standard thermodynamic methods. For each donor-acceptor system ΔH*AD₂ values are approximately 0.5 kcal mol⁻¹ smaller than the corresponding ΔH*AD. Entropy changes for the equilibrium step leading to the formation of the termolecular species are about 4 e.u. more negative than for the initial bimolecular interaction. These results indicate that variations in the TAS term are some two to three times as important as ΔH in determining the relative equilibrium constants for the formation of AD and AD₂.

The Hydrolysis of Some Aromatic Anhydrides in the Presence of Cycloheptamylose: Kinetics of Intermediate Ester Hydrolysis. R. L. Shankle, C. E. Harding, and C. R. Wasmuth, The University of Tennessee at Martin. Ester formation has been detected in the conversion of some para-substituted benzoic anhydrides to acids in alkaline solutions containing cycloheptamylose. The rate constants measured at 245 mm for hydrolysis of the ester intermediates from p-methylbenzoic anhydride and p-*tert*-butylbenzoic anhydride were found to be nearly equal (± 10%) to the rate constants for hydrolysis of the ester intermediates from m-chlorophenyl p-methylbenzoate and m-chlorophenyl p-*tert*-butylbenzoate, respectively. The results are discussed in terms of a mechanism that includes formation of a cycloheptamylose-anhydride inclusion complex.

Preparation of Elemental Isotopic Material for Targets. J. O. Younghane, E. W. McDaniel, and H. H. Caudill, Oak Ridge National Laboratory. Various techniques are discussed which are used to reduce isotopic compounds to the elemental state. The elements are grouped according to ease of refinement and reduction, and referred to as simple, difficult and complicated. A representative example from each group is discussed.

Cadmium, being of interest to makers of the cadmium-helium laser, is discussed in detail from the "difficult" group.

From the "complicated" group, metals prepared by the Van Arkel-de Boer Iodide Process, commonly referred to as crystal bar metal, are discussed in general terms using various slides. Silicon, which can be prepared by the Iodide Process, is mentioned (slide).

GEOLOGY AND GEOGRAPHY SECTION

ENGINEERING, 203

ROBERT BURCHETT, *Chairman*

A System for Quantifying Environmental Geology in Land-Use Planning. Robert A. Miller, Tennessee Division of Geology (20 min.)

Energy Crisis—Past, Present, and Future. John W. Ruch, Consulting Engineer (30 min.)

Petrology of Core Samples from a Pennington Carbonate Tidal Flat Complex, Sand Mountain, Alabama.

Alexander McGregor and Richard E. Bergenback, The University of Tennessee, Chattanooga (20 min.)

Darks Mill Local Fauna (Pleistocene: Wisconsin), Maury County, Tennessee. James X. Corgan, Tennessee Division of Geology and Austin Peay State University (20 min.)

Effective Area of Individuals, Communities and Societies. Robert T. Nash, Vanderbilt University (20 min.)

Tennessee's Newest Aquifer, Charles R. Burchett, U.S. Geological Survey (15 min.)

Election of Section Officers for 1974.

A System for Quantifying Environmental Geology in Land-Use Planning. Robert A. Miller, Tennessee Division of Geology. Data on four major categories of earth science (geology, hydrology, soils, and topography) are used to provide an objective approach to that phase of land-use planning which involves environmental considerations. Individual factors within each of these categories are evaluated (rated) on a numerical scale, and the resulting ratings are used to "score" alternative sites being considered for a specific land-use. The main uses to which these ratings apply are intense urban development, residential and associated development, agriculture, mining, and natural areas.

The ratings are based on a scale of 1 to 5 in which a rating of 5 indicates the highest suitability and a rating of 1 the least suitability for a specific use. An overall suitability rating is derived by determining the average rating for each of the four categories. These are then "weighted" by applying a percentage factor based on the relative importance of each to the specific land-use, and a final rating results.

Energy Crisis—Past, Present, and Future. John W. Ruch, Consulting Engineer. Energy sources have been strained on repeated occasions, from prehistory to the present shortage of heating oil and propane. A few examples will be examined.

A presentation of the patterns of current usage will be shown and trends examined for a look into the future. The causes of the present shortage will be noted and comments included for future forecasts.

Both short-term and long-term solutions for adequate energy sources will be suggested.

Petrology of Core Samples from a Pennington Carbonate Tidal Flat Complex, Sand Mountain, Alabama. Alexander McGregor and Richard E. Bergenback, The University of Tennessee at Chattanooga. Ninety two feet of Carboniferous carbonate core offers a unique opportunity for study of the Pennington Formation, since exposures of this formation are rare in the vicinity of Sand Mountain, Alabama.

Ferm and Ehrlich (1967) described Pennsylvanian clastic sediments of Alabama as a prograding deltaic complex with offshore quartz sand barriers. Bergenback, Horne and Inden (1972) described the Pennington Formation near Monteagle, Tenn. and considered it as part of a tidal-flat complex.

Eight facies are present in this core. They are:

Facies	Interpretation
1. Laminated, dolomitized micrite	High intertidal, tidal-flat complex
2. Bio-oosparite with rip-up clasts	Subtidal, tidal channel
3. Dessicated micrite with clastic clay dikes	Intertidal, tidal-flat
4. Pelsparite with birdseyes	Supratidal or high intertidal, Algal mat
5. Bleached Pelmicrite	Supratidal or high intertidal, Pellet mounds
6. Laminated, argillaceous biomicrite	Low intertidal, lower tidal-flat
7. Oo-biosparite	Intertidal or subtidal, beach ridge or barrier
8. Laminated biomicrite with chert	Subtidal or low intertidal, lower tidal-flat

Darks Mill Local Fauna (Pleistocene: Wisconsin), Maury County, Tennessee. James X. Corgan, Tennessee Division of Geology and Austin Peay State University. Vertebrate fossils occur in an open-pit phosphate mine near Darks Mill, Maury County, Tennessee. There are two fossiliferous lithologies, dark clay and yellowish gravelly sand. The clay contains plant fragments, turtle, giant ground sloth, and mastodon. These establish a Pleistocene (Wisconsin) age. Yellowish sediments yield bone and ivory splinters, with mastodon the only species provisionally identified. The clay is interpreted as a subaqueous sediment deposited within a water hole. Sand reflects on-shore accumulation. Monsanto Chemical Company, the mine owner, will soon expose fossiliferous sediments to permit intense study. This may provide the first paleontologic evidence of the time of origin of Maury County phosphate ores.

The Effective Area of Individuals, Communities, and Societies. Robert T. Nash, Vanderbilt University. Much attention is being directed toward the question of the sustainable population of the several continents of the earth. Historically such investigations were restricted to the influence of the quantity and reliability of the food supply, and the availability of fuels. However, recorded examples also substantiate the contention that factors which are primarily social in character also affect population. In this discussion the concept of the Effective Area of an Individual is developed. The effective area is the net amount of the earth's surface given over for the sustenance, or use, of one individual. This view accounts for all uses of land by, or for, an individual; not just those related to agriculture and the other productive activities. Comparisons are made between the current values of the effective area for individuals in Europe, North America, and Asia.

Tennessee's Newest Aquifer. C. R. Burchett, U.S. Geological Survey. Recent test drilling revealed the presence of a high yielding aquifer in the southern Highland Rim. The aquifer is at least 50 miles in extent and possibly much larger as evidenced by the analysis of data from test holes in Manchester, Tullahoma, and Lincoln County, Tennessee.

The aquifer, named the Manchester aquifer, is within the Fort Payne Formation. The upper part of the aquifer consists of highly permeable chert rubble in the bottom of the weathered zone of the Fort Payne, and the lower part of the aquifer consists of solution openings in the uppermost few tens of feet of the underlying bedrock which is 70 to 90 feet below land surface. Test holes at three different sites in the southern Highland Rim have penetrated 10 to 49 feet of chert rubble from which about 200 gpm (gallons per minute) of fresh water have been withdrawn. Most of these wells have also penetrated sizeable solution openings in the underlying bedrock from which an additional 100 gallons per minute or more of fresh water have been withdrawn. Doubtless, larger yields could be obtained from larger diameter adequately developed production wells.

This aquifer has great potential throughout its area of occurrence as an inexpensive water source for municipal and industrial use. Further drilling and testing are needed to define in detail the area of occurrence and potential for long-term yield.

MATHEMATICS SECTION

STEVENSON, 1320

RONALD SIRCY, *Chairman*

Application of Conformal and Quasiconformal Mapping to Airfoil Theory. John A. Kelings, Vanderbilt University (20 min.)

New Type of Convolution Integral. M. K. Jain, The University of Tennessee, Martin (20 min.)

Some Properties of the Gaussian Binomial Coefficients. V.R.R. Uppuluri and J. A. Carpenter, Union Carbide Corporation, Nuclear Division (20 min.)

When You "Remove" a Removable Singularity. Do You "Remove" the Singularity? John Kinloch, East Tennessee State University (20 min.)

Application of Conformal and Quasiconformal Mapping to Airfoil Theory. John A. Kelings, Vanderbilt University. One of the most striking applications of mathematics to the physical sciences has been that of complex analysis to incompressible fluid flow. The rather complete development of the theory of quasiconformal mapping during the 1950's and 1960's has made it possible to attack in a similar fashion certain problems in compressible fluid flow, in particular, uniformly subsonic flow, and even in some cases, transonic flow. A brief description of the method is discussed, which includes the generalized Riemann mapping theorem for quasiconformal mappings.

New Type of Convolution Integral. M. K. Jain, The University of Tennessee at Martin. Investigations of inversion formula and a new type of convolution integral presented.

Some Properties of the Gaussian Binomial Coefficients. V. R. R. Uppuluri and John A. Carpenter, Computer Sciences Division ORNL. The Gaussian binomial coefficient is introduced as the generating function of the number of partitions of m into at most n parts with each part not exceeding b . Several properties analogous to those of the ordinary binomial coefficient are shown. Applications to problems in graph theory, enumeration problems in finite dimensional vector spaces and rank sum tests in statistics are summarized.

"When You 'Remove' A Removable Singularity, Do You 'Remove' the Singularity?" John Kinloch, East Tennessee State University. The singular point is called a removable singularity of the complex-values function. In elementary texts on complex variables, the fact is often asserted and used, that 'removing' a removable singularity transforms a point of singularity of a function into a point of analyticity of the function. In this paper we show that the assertion is true.

SCIENCE AND MATHEMATICS TEACHERS SECTION

STEVENSON, 5326

WILLIAM N. PAFFORD, *Chairman*

Earth Science Teacher Preparation: A State-Wide Perspective. R. Jerry Rice and James X. Corgan, Tennessee State Department of Education and Austin Peay State University (20 min.)

A Curriculum Study of Science Course Offerings. Mildred B. Perry, Clarksville High School (20 min.)

A Grade Contract Plan for a Course in Secondary Science Teaching Methods. Herbert Armentrout, East Tennessee State University (10 min.)

Individualized Science Instruction: Rationale and Definition. Carl Stedman, Austin Peay State University (20 min.)

Environmental Education in the Kingsport City School System. Ronald B. Childress, Kingsport City Schools (20 min.)

Water Pollution Studies by a High School Ecology Club. Michael D. Filson, Clarksville High School (20 min.)

The Implementation of Science: A Process Approach in the Chattanooga and Hamilton County Schools. B. W. Benson, The University of Tennessee, Chattanooga (15 min.)

Development of Cinemicrophotographic Teaching Aids with Inexpensive Equipment. R. Gary Litchford, The University of Tennessee, Chattanooga (20 min.)

Earth Science Teacher Preparation: A State Wide Perspective. R. Jerry Rice and James X. Corgan, Tennessee State Department of Education, Nashville, Tennessee 37219 and The Center for Teachers, Austin Peay State University, Clarksville, Tennessee 37040. Earth and space science is a rapidly expanding teaching field in Tennessee secondary schools. Two new teacher certification programs will go into effect in February, 1974. Certifications are only meaningful if colleges offer courses that meet requirements. This paper describes the development of Tennessee's new certifications and reports on relevant course offerings in 53 post-secondary institutions. Almost half of all four-year schools can graduate students who meet broadfield certification requirements and 13 percent have courses that meet requirements for single-subject endorsement. Data used in this study reflect course offerings prior to announcement of certifications. Changes in future years should show the impact of new secondary school certifications on college curricula.

A Curriculum Study of Science Course Offerings. Mildred B. Perry, Clarksville High School. A survey of science course offerings was conducted in 34 secondary schools in ten states. Student and teacher questionnaires were utilized. The data revealed a variety of course offerings, many which had not been anticipated, in secondary schools. From the data, the research team designed a superficial profile of science course offerings across the United States. Specific comparisons were made with Clarksville High School. We plan to use the study to help us further develop an enhance our own science curriculum.

A Grade Contract Plan for a Course in Secondary Science Teaching Methods. Herbert Armentrout, East Tennessee State University. A description of a course offered at East Tennessee State University during the 1972-1973 academic year in methods of teaching general science and biology in secondary schools is presented. The philosophy for the design of the course is discussed, and a subjective evaluation is made of its reception by the students. Some comparison is made with traditionally structured methods courses.

Individualized Science Instruction: Rationale and Definition. C. H. Stedman, Austin Peay State University. The term "individualized instruction," like many other pedagogical terms, is vague and nebulous and embodies not only methodological considerations but philosophical ones as well. It will be the purpose of this presentation to identify a rationale behind the development of individualized approaches to instruction and to expose the full continuum of responses or practices which are based upon this rationale.

Many past recommendations related to pedagogy and the purposes of education have been identified over several decades which are or have been instrumental in developing attitudes and practices which have led to individualized instruction. Yet, there also appears to be a very contemporary perspective which introduces an urgency which was not present before. This newer concept of the purpose of education has produced a new insight which suggests a need to restructure education at all levels.

Stress Analysis of Prosthetic Devices. J. E. Akin and William B. Campbell, Jr., The University of Tennessee, Knoxville (20 min.)

Fluid Dynamics of Vascular Disease. J. H. Forrester, The University of Tennessee, Knoxville (15 min.)

Design of an Animal Enclosure for Inducing Polycythemia. William T. Snyder, The University of Tennessee, Knoxville (10 min.)

Intermission (10 min.)

A Comparison of Thrombocytes from Bursectomized and Intact Chickens. Carol Grigg and Marion Wells, Middle Tennessee State University (15 min.)

Housedust Algae as Possible Allergenic Factors in Humans. Richard D. Holland, Patricia L. Walne, and Robert P. Hornsby, The University of Tennessee and Memorial Research Center and Hospital, Knoxville (15 min.)

Evidence for Separate Initiation and Inhibitory Sites in the Regulation of Membrane Potential of Electrophax: Kinetic Studies with alpha-Bungarotoxin. J. E. Bulger, Memphis State University (10 min.)

Medimatics and Cybernetic Medicine. T. C. Helvey, Institute of Information and Control Systems, Tullahoma (30 min.)

Ion Effects in in vitro ss-DNA Synthesis. T. Chirpich, Memphis State University. Calf thymus terminal deoxynucleotidyl transferase synthesizes homopolymers using an oligonucleotide or a polynucleotide as initiator and a single deoxynucleotide triphosphate as the polymerized substrate. The reaction was found to proceed at a maximal rate in potassium cacodylate buffer and at 3- to 10-fold lower rates in the Good buffers, MES, HEPES, and TES. In general, addition of anions to the reaction solution was detrimental, with Cl^- , Br^- , I^- , NO_3^- , CH_3COO^- , SO_4^{2-} , and ClO_4^- causing inhibition at less than 0.2 M. Potassium appeared to be a required monovalent ion since substitution by Na^+ , NH_4^+ , or Tris resulted in less than 10% of maximal activity. Disruption of the enzyme structure also occurred readily with other perturbations, for the addition of dimethyl sulfoxide, ethanol, acetone, or dimethyl formamide resulted in reduced activity. None of the above perturbations resulted in a shift towards replicative polymerase type activity.

Continuous Flow Centrifuge for the Separation of Blood Cells. C. J. Remenyik, The University of Tennessee at Knoxville. Leukemia patients, and certain other patients, need white blood cells, particularly granulocytes, from human donors. The large number of granulocytes needed prohibits transfusion of whole blood. A centrifuge has been developed for continuous separation of white blood cells from whole blood. Blood is channeled from the donor's blood vessel directly into the centrifuge where white blood cells are separated. These are collected and the rest of the blood is returned to the donor. This centrifuge was developed from earlier models (now commercially available) by applying new fluid dynamical concepts. The operation of the centrifuge is made automatic by incorporating various probes which monitor blood cell concentrations and generate signals for the regulation of pumps and the centrifuge speed. This device may be used, for other purposes also, for example, for the separation of certain components from the blood or other fluids of experimental animals.

Stress Analysis of Prosthetic Devices. J. E. Akin and William B. Campbell, Jr., The University of Tennessee at Knoxville. The designers of a prosthesis are often faced with the difficult problem of analyzing the structural interaction of the prosthesis and its implant site. An accurate stress analysis of this interaction aids the designers in selecting the prosthesis geometry and material properties that lead to an optimum load transfer between the bone and implant. The results of such an analysis can be utilized to reduce the amount of time, money, and experimental

One of the more interesting facets of this entire area is trying to decide whether we are indeed playing a new game or merely engaged in a slightly disguised old one.

Environmental Education in the Kingsport City School System. Ronald B. Childress, Kingsport City Schools. The Kingsport City School System began planning for an environmental education program in 1970. Beginning with a nature study program for fourth, fifth and sixth grade students and the employment of a fulltime coordinator, the program has since grown into a total environmental education program spanning all grade levels and including in-service training for teachers.

Centered around environmental problems and the wise use of resources, the program is interdisciplinary, activity focused, involvement oriented and directed toward making education more relevant to the real life situation of the learner. The overall program consists of four inter-related phases: day-use of community resource facilities; development and utilization of environmental study areas on school sites; participation in a residence environmental education program; and the planning, development and implementation of a mobile environmental education laboratory through a cooperative demonstration project with the Tennessee Valley Authority. All phases of the program are preceded and followed by related classroom instructional activities and projects.

Water Pollution Studies by a High School Ecology Club. Michael D. Filson, Clarksville High School. A survey of the physical, chemical, and biological conditions of the Red River in Montgomery County, Tennessee is being conducted by an ecology club of Clarksville High School. The survey will be conducted during the winter of 1972 through the fall of 1973. Standard methods of water analysis and investigation are being utilized.

Six tests sites were chosen along the river in accordance to road approaches and two additional sites, one above and one below the Red's passage into the Cumberland River, were used.

Student teams conducted a total of ten tests at each location and notes were taken as to the physical appearance of the river at each site.

Winter, spring, and summer season examinations have been conducted with fall survey remaining. At the completion of the fall survey, data will be examined as to the water's seasonal changes over a period of one year.

The Implementation of Science—A Process Approach in the Chattanooga and Hamilton County Schools. B. W. Benson, University of Tennessee at Chattanooga. The evolving patterns of administration and instruction in this three year sequential program designed to implement S-APA will be discussed. S-APA is a kindergarten through grade six science curriculum project developed through the Commission on Science Education of American Association for the Advancement of Science with financial support from the National Science Foundation. Factors influencing the success of this program will be identified. Emphasis will be placed on elucidating the mechanisms inherent in the program's design that could be utilized in similar implementation programs. Of especial significance are the cooperative arrangements which have emerged involving the University staff and administration, school system central office personnel, and classroom teachers.

Development of Cinemicrophotographic Teaching Aids with Inexpensive Equipment. R. G. Litchford, The University of Tennessee at Chattanooga. A discussion of the equipment used will be followed by a presentation of edited and non-edited film. These films were prepared to be used in an introductory course in Parasitology.

MEDICAL SCIENCES SECTION I

ENGINEERING, 239

J. R. MASON, *Chairman*

Ion Effects in in vitro ss-DNA Synthesis. T. Chirpich, Memphis State University (15 min.)

Continuous Flow Centrifuge for the Separation of Blood Cells. C. J. Remenyik, The University of Tennessee, Knoxville (15 min.)

tion required to develop a prosthesis designed for human application.

The finite element method of stress analysis is probably the most practical technique for solving these problems. The paper outlines the advantages of the finite element method and the difficulties encountered in this type of application.

The Fluid Dynamics of Vascular Disease. J. H. Forrester, The University of Tennessee at Knoxville. One of our areas of interest at the University of Tennessee is to learn more about the relationships which exist between flow characteristics of blood and the pathological problems associated with occlusive vascular disease. Thus, we are interested in thrombus and plaque formation, dilatation, and the transport of materials into and out of the vessel wall. From a fluid dynamics point of view, we are interested in locating regions of high and low wall shearing stress, high and low pressures, and separated flow regions in order to better assess some of the speculations which have been made relating flow characteristics to such problems as continued ingrowth of a stenosis, thrombus formation, and post-stenotic dilatation.

Design of an Animal Enclosure for Inducing Polycythemia by Hypoxia. William T. Snyder, The University of Tennessee at Knoxville. Polycythemic animals are useful as laboratory animals for erythropoietin assays. The simplest procedure for inducing polycythemia is by hypoxia.

Lange et al have induced polycythemia in mice by using an animal enclosure covered with silicone rubber membrane. The membrane material has different permeabilities for oxygen and carbon dioxide which permits attainment of a steady state level of hypoxia.

This paper will present a rational engineering design procedure for design of an animal enclosure to produce predetermined levels of hypoxia. The design model is based on the conservation equations for oxygen and carbon dioxide and includes the following parameters: enclosure volume and temperature, membrane area, inspiration and expiration rates of the animal involved, permeability properties of the membrane material. The design equations give the time dependent behavior of oxygen concentration in the enclosure as well as the asymptotic steady state concentration. A comparison between the theory and experimental data will also be presented.

A Comparison of Thrombocytes from Bursectomized and Intact Chickens. Carol Grigg and Marion Wells, Middle Tennessee State University. To better understand the immunological role of the Bursa of Fabricius in chickens, chicken thrombocytes (phagocytic cells) were studied in surgically and hormonally bursectomized chicks and in intact chicks ranging in age from 3 to 8 weeks. Anti-thrombocyte sera produced in rabbits were reacted with thrombocytes from intact and bursectomized chicks. Based on a cytotoxicity test, there was a highly significant difference between the thrombocytes from intact chickens and the thrombocytes of bursectomized chickens.

Housedust Algae as Possible Allergic Factors in Humans. Richard D. Holland, Patricia L. Walne, and Robert P. Hornsby, M.D. University of Tennessee and Memorial Research Center and Hospital, Knoxville. Studies in our laboratory have shown that a number of viable algae are significant components of housedust. Reports in medical and biological literature have implicated both algae and housedust as causative agents in some types of allergies in humans. Thus, since some of the housedust algae may be allergenic, selected genera have been isolated, purified and grown in batch cultures for subsequent use in the preparation of extracts for clinical sensitivity tests. For nine months, biweekly samples of housedust have been collected from five homes and returned to the laboratory. After sieving, 0.1 g aliquots of dust were inoculated into five different media, incubated under standard conditions and examined microscopically to identify the algal flora. Modifications of an agar-plate technique described by Bernstein and Safferman have been used in attempts to quantify the algal components of housedust samples. Representative organisms of the predominant algal groups will be used in clinical aspects of the study.

Evidence for Separate Initiation and Inhibitory Sites in the Regulation of Membrane Potential of Electroplax Kinetic Studies with α -Bungarotoxin. J. E. Bulger, Memphis State University. The minimum reaction mechanism for the irreversible reaction of α -bungarotoxin with membrane preparations of

Electrophorus electricus involves a rapid reversible phase ($K_{diss} = 0.2 \mu M$) followed by an irreversible reaction ($k = 0.038 \text{ min}^{-1}$). Compounds which initiate changes in membrane potential of electroplax affect only the rate of reaction but not the binding of toxin to the membrane. d-Tubocurarine which inhibits membrane potential changes, as does α -bungarotoxin, is a competitive inhibitor which affects toxin binding but does not affect the rate of reaction. The simplest explanation of this is that membrane potential changes are controlled by two different sites, one for initiators and the other for inhibitors.

Medimatics and Cybernetic Medicine. Dr. T. C. Helvey, Institute of Information and Control Systems, Tullahoma. Medimatics is the science of mathematical modeling of biological functions in normal and diseased subjects. It is a specific part of cybernetic medicine, which transforms the descriptive and approximative medical language into logical and mathematical expressions for the use of computers and systems theories.

Some of the practical applications are, for example, the exact posology of digitalis, medigraphic methods (which some called "electronic vivisection"), models of cardiovascular and nervous regulation, as well as cardiac ischemia. Algorithms were developed for arteriosclerosis and for optimization of surgical strategies.

Cybernetic medicine has become an "umbrella" which covers a number of well defined subspecies, such as Brain Cybernetics, Psycho-Cybernetics, Rheumatology, etc., and deals also with interpersonality interactions, social system dynamics, as well as automated health care delivery. The role of artificial intelligence, a tool and purpose of general cybernetics, becomes increasingly applicable in cybernetic medicine.

The lecture gives a brief overview and the state-of-the-art of the field and is pointing out its potential as well as the limitations.

MEDICAL SCIENCES SECTION II

ENGINEERING, 301

JOHN E. BAXTER, *Chairman*

Suppression of Activity by Amphetamine in the Goldfish. Frederick Petty, Rodney C. Bryant, Judith L. Warren, and William L. Byrne, University of Tennessee Medical Units, Memphis (15 min.)

Oscillations of the Level of Acyl Carrier Protein (ACP) in Escherichia coli. John D. DeLoach, James J. Aquanno and Allan R. Larrabee, Memphis State University (15 min.)

A Bifunctional Enzyme from Salmonella typhimurium: Purification or Fragmentation. J. E. Brady, Memphis State University (15 min.)

A Study of Thyroidal Hormone Stability in Human Serum. David Benson and Marion Wells, Middle Tennessee State University (15 min.)

Intermission (10 min.)

Changes Occurring in the Cortical Fibrils of Human Hair during Keratinization: An Electron Microscope Study. Marion H. Garrett, University of Tennessee Medical Units, Memphis (15 min.)

Abnormal Lipoprotein of Extrahepatic Cholestasis in Rats. Lynn A. LaBounty, Mary E. Gray, and Virgil S. LeQuire, Vanderbilt University (10 min.)

Isolation and Characterization of Lamellar Bodies from Rat Lung Homogenates. Mary E. Gray, Sally Liau, Mildred Stahlman, and V. S. LeQuire, Vanderbilt University (10 min.)

Studies on Sarcoplasmic Reticulum from Skeletal Muscle of Normal and Myotonic Goats. Larry L. Swift and Virgil S. LeQuire, Vanderbilt University (10 min.)

The Effects of Crude Marijuana Extract (CME) 25%-Delta 9 Tetrahydro Cannabinol (THC) on the Time of Development in Drosophila: A Preliminary Study. Larry H. Elkins, R. D. Ikenberry, and D. B. Benner, East Tennessee State University (10 min.)

Amphetamine Suppresses Activity in the Goldfish. Frederick Petty, Rodney C. Bryant, Judith L. Warren and William L. Byrne. Dextroamphetamine sulfate suppressed spontaneous locomotor shuttling activity in the common goldfish (*Carassius auratus*). The drug was administered through the technique of immersion, and activity was monitored with an automated array of ten goldfish shuttlebox activity chambers (29 x 18 x 13 cm lwd) with activity counts recorded when the fish crossed the center of the box. Controls were run simultaneously with animals receiving the drug solution. Dose related suppression of shuttling was found with doses of 0.2, 2, 25, 50, and 100 mg/l. The lowest dose did not significantly affect activity while the higher doses suppressed shuttling in a dose related manner. Similar effects were observed when the drug was administered via intracranial injection of 1, 2 and 10 mg/kg doses. Pharmacologically active doses are 2-5% of lethal doses. The observed effects on activity with amphetamine in the goldfish are in contrast to its effect in other species, and possible reasons for this difference—neuro-anatomical or neurochemical—are discussed.

Oscillations of the Level of Acyl Carrier Protein (ACP) in Escherichia coli. John R. DeLoach, James J. Aquanno, and Allan R. Larrabee, Department of Chemistry, Memphis State University, Memphis, Tennessee 38152. CoA serves as an acyl carrier in the β -oxidation of fatty acids. Similarly, ACP serves as an acyl carrier in fatty acid synthesis. CoA is the precursor of the covalently bound 4-phosphopantetheine prosthetic group of ACP. The level of ACP in asynchronous, synchronous, and drug inhibited cultures of *E. coli* oscillates with a period of approximately 20 to 40 minutes. A chemostat was utilized to eliminate and subsequently induce the oscillations by changes in the level of pantothenate given to a pantothenate auxotroph. A model is proposed which explains this behavior and is based on changes in the activity of the enzymes which catalyze the exchange of the prosthetic group of ACP.

A Bifunctional Enzyme from Salmonella Typhimurium, Purification or Fragmentation. D. R. Brady, Memphis State University; L. L. Houston, University of Kansas. The bifunctional enzyme imidazoleglycerol phosphate dehydratase-histidinol phosphate phosphatase has been isolated and purified from *Salmonella typhimurium*. The enzyme exhibited extensive molecular weight changes during purification. Mn^{++} was instrumental in affecting these molecular weight changes. Molecular weights varied from greater than 300,000 to 75,000 as determined by Sephadex chromatography. During purification of the enzyme, the ratio of dehydratase activity to phosphatase activity decreased and the ability of Mn^{++} to influence aggregation diminished. Homogeneous samples of enzyme, as evidenced by single bands resulting from polyacrylamide gel electrophoresis, were shown to consist of several small molecular weight fragments (38,000 and less) using SDS-polyacrylamide gel electrophoresis. The extensive fragmentation was not prevented by the addition of diisopropyl-fluorophosphate during the purification procedure.

A Study of Thyroidal Hormone Stability in Human Serum. David Benson and Marion Wells, Department of Biology, Middle Tennessee State University. Blood was collected from 10 patients to determine the effect of temperature and storage of blood on the T-3 (3,5,3'-L-triiodothyronine) and T-4 (thyroxin or 3,3',5,5'-tetraiodothyronine) levels using the Tetra Tab and Tri Tab method of the Nuclear Medical Laboratory. In serum samples with gross hemolysis there was a marked reduction in the T-3 and T-4 levels. Such samples for assay should be rejected.

Changes occurring in the Cortical Fibrils of Human Hair during Keratinization, An Electron Microscope Study. M. H. Garrett, University of Tennessee Medical Units, Anatomy Department. Cortical fibrils of human hair first appear to consist of granules about 5-6 μ in diameter arranged in irregular rows about 15-35 μ in width separated by an electron-lucent area

having about the same width. The rows of granules tend to follow a curved or spiral course within the fibrils. The fibrils increase in diameter as the cells move upward in the follicle. Soon dense rod-shaped structures appear in the fibrils. This dense material spreads throughout the fibril demarcating lighter areas (60-110 μ in diameter) which have been called filaments. The "filaments" appear to be irregularly subdivided by small granules. As the fibrils continue to increase in diameter and the other cytoplasmic contents decrease in amount the edges of adjacent fibrils coalesce. The "filaments" become less distinct in character and as keratinization is completed the dense granules are spread rather evenly throughout the lighter background material.

Abnormal Lipoprotein of Extrahepatic Cholestasis in Rats. Lynn A. LaBounty, May E. Gray, and Virgil S. LeQuire, Vanderbilt University School of Medicine. For a number of years hypercholesterolemia and hyperphospholipidemia have been recognized clinically in cases of obstructive jaundice. Recently, an abnormal lipoprotein has been described in patients with cholestasis that is largely responsible for the increases in serum free cholesterol and phospholipid levels. This lipoprotein has now been isolated from rats having extrahepatic biliary obstruction by a combination of ultracentrifugation and agarose gel filtration. It is characterized by the following features: (1) disc-shaped particles measuring 300-500 μ along their major axes and 100 μ along their minor axes; (2) a tendency for these particles to form rouleaux; (3) a composition of 63.3% phospholipids, 30.0% free cholesterol, and only 2.3% esterified cholesterol; (4) the major phospholipid being phosphatidylcholine, with smaller but appreciable amounts of sphingomyelin and lysophosphatidylcholine. These data are similar to those found in compositional studies of the abnormal lipoprotein in humans with cholestasis. Thus, the rate may serve as a model system for studies of obstructive jaundice.

Isolation and Characterization of Lamellar Bodies from Rat Lung Homogenates. Mary E. Gray, Sally Liau, Mildred Stahlman and V. S. LeQuire, Vanderbilt University School of Medicine. The Type II pneumocyte with its characteristic lamellar bodies has been linked inferentially with pulmonary surfactant production. The precise role of the lamellar body is not known, but the development of normal surface activity in fetal lung has been associated with the appearance of these structures. A surface active fraction, rich in lamellar bodies, has been isolated from rat lung homogenate by ultracentrifugation. The lipid composition of the lamellar body-rich cell fraction was approximately 89% phospholipids, 8% total cholesterol and 3% triglycerides and unesterified fatty acids. The phospholipid composition was 61% phosphatidyl choline (PC), 27% phosphatidylethanolamine, 8% sphingomyelin and 1.5% phosphatidyl serine. The fatty acids of the PC were 80% saturated with palmitic acid the largest component. Enzyme assays indicated the presence of choline kinase and phosphatidyl methyltransferase. We suggest that the lamellar bodies of the Type II pneumocytes are at least one source of components of pulmonary surfactant.

Studies on Sarcoplasmic Reticulum from Skeletal Muscle of Normal and Myotonic Goats. Larry L. Swift*, Ph.D., and Virgil S. LeQuire, M.D., Department of Pathology, Vanderbilt University School of Medicine, Nashville, Tennessee 37232. Myotonia congenita is a muscle disorder which is characterized by an abnormally slow relaxation of the muscle fibers. Since the sarcoplasmic reticulum regulates Ca^{++} distribution within the cells and thus controls contraction and relaxation of the fibers, it seems plausible that the slow relaxation in myotonic muscle could be due to a defect in the sarcoplasmic reticulum (SR) membranes. To investigate the possibility, SR membranes from skeletal muscle of normal and myotonic goats were isolated, and the membranes were compared with respect to lipid, protein, and fatty acid composition, carbohydrate composition, and Ca^{++} uptake ability. The lipid, protein, and fatty acid composition were found to be very similar. Myotonic SR membranes, however, have more sialic acid associated with them than do the normal SR membranes. Additionally, SR from myotonic muscle is able to accumulate more Ca^{++} than the SR from normal muscle. These data will be discussed in relation to muscle contraction.

The Effects of Crude Marijuana Extract (CME) 25%-Delta 9 Tetrahydro Cannabinol (THC) on the Time of Development

in *Drosophila*: A Preliminary Study. Larry H. Elkins, R. D. Ikenberry, and D. B. Benner, East Tennessee State University. Increased activity, time spent in feeding, and increased oxygen consumption have all been observed in mice exposed to marijuana smoke (Bachman, 1970, M.S. thesis, E.T.S.U., Ikenberry and Bachman, 1973, JTAS, 48:57) and in animals fed crude marijuana extract (CMS) (unpublished data). These results suggest that CME is increasing the metabolic activity of the treated animals. To test this possibility *Drosophila* larvae were exposed to CME to determine if the time of development could be modified.

Mature flies were placed on CME dosed food and allowed to deposit eggs for a limited time period. Adults were collected and counted twice daily as they eclosed from the pupae cases.

A standard corn meal, sorgum syrup media was used, and the matings and development took place at $25 \pm 1^\circ \text{C}$.

The results suggest that at high doses (0.4, 0.2, 0.1, and possibly 0.05 mg/ml) there is a tendency for flies to eclose earlier. Medium doses (0.025 and 0.0125 mg/ml) do not appear to have any influence on eclosion time, and low doses (0.00625 mg/ml) appears to have an inhibitory effect, delaying eclosion time.

PHYSICS AND ASTRONOMY SECTION

STEVENSON, 5312

MARVIN TIDWELL, *Chairman*

Papers submitted to the American Association of Physics Teachers were presented. No abstracts were submitted for publication in JTAS.

ZOOLOGY SECTION I

STEVENSON, 1308

C. R. MCGHEE, *Chairman*

Congruence Between Classical and Numerical Cladistic Methods in Constructing Cladograms of the Family Pteronarcidae (Insecta: Plecoptera). Charles H. Nelson, The University of Tennessee, Chattanooga (15 min.)

Survey of the Gerridae (Insecta: Hemiptera) in the Tennessee Inner Central Basin. Larry D. Smith, Middle Tennessee State University (15 min.)

A Survey of Cercariae From Aquatic Snails in Rutherford County, Tennessee. Vithoon Viyanant, Middle Tennessee State University (15 min.)

Distributional Factors of Selected Intertidal Meiobenthos on Ship Island, Mississippi. L. W. Bennett, Vanderbilt University (10 min.)

Leeches of the Stones River Drainage Area in Middle Tennessee. Steve D. Maloney, Middle Tennessee State University (15 min.)

Intermission (10 min.)

The Tardigrada (Water Bears) of Roan Mountain. Diane R. Nelson, East Tennessee State University (15 min.)

Development of the Tarsal Elements of *Drosophila* Legs. D. B. Benner, East Tennessee State University (10 min.)

Acid Pollution in Wilderness Streams: Great Smokie Mountains National Park. Eric Morgan and Don D. Jones, Tennessee Technological University (10 min.)

The Use of Manometric Techniques in Screening Potentially Hazardous Environmental Materials. Richard C. Young and Eric L. Morgan, Tennessee Technological University (10 min.)

Vertical Distribution of Total Suspended Solids and Selected Physical and Chemical Parameters in a Thermally Stratified Reservoir. Richard S. Austin, Dept. of Biology, Tenn. Tech University, Cookeville, Tenn. (10 min.)

A Preliminary Study of Dissolved Oxygen Depletion in the Thermocline of Center Hill Reservoir. John W. Tibbles, Jr. and Eric L. Morgan, Tennessee Technological University (10 min.) No abstract provided.

Congruence between Classical and Numerical Cladistic Methods in Constructing Cladograms of the Family Pteronarcidae (Insecta: Plecoptera). C. H. Nelson, University of Tennessee at Chattanooga. Congruence between classical and numerical cladistic procedures in constructing cladograms is examined. In an earlier study on the twelve species of the family Pteronarcidae, Nelson and Hanson (1971; Trans. Amer. Entomol. Soc., 97: 123-200) generated a cladogram using the classical methods of Hennig (1966; Nniv. of Illinois Press, pp. 1-263). This method emphasizes that only advanced states of a character can be used to infer branching relationships of the OTU's comprising a group of organisms. In this present study 38 characters were selected from Nelson and Hanson's work and were analyzed using the quantitative procedures of Farris (1970; Syst. Zool., 19:83-92). A comparison of the cladogram generated by numerical cladistics with that generated by classical methods reveals no difference. Although these results indicate close agreement between both methods, utilization of the classical method involves *a priori* assumptions concerning homoplasy as well as the relative advancement or primitiveness of characters.

A Survey of Cercariae from Aquatic Snails in Rutherford County, Tennessee. By Vithoon Viyanant. During the summer of 1973, a total of 12,840 snails belonging to the genera *Goniobasis*, *Pomatopsis*, *Viviparus*, *Physa*, *Helisoma*, *Gyraulus*, *Lymnaea*, and *Somatogyrus* were collected from 24 locations in Rutherford County, Tennessee. Emergent mature cercariae were studied as living and mounted specimens. Twenty species of cercariae were found, 18 had never been reported in Tennessee. These species included: nine xiphidocercariae, four monostome cercariae, two furcocercous cercariae, two echinostome cercariae, two microcercous cercariae, and one cystocercous cercariae. Trematodes parasitized approximately 1.8 percent of the total number of snails.

Distributional Factors of Selected Intertidal Meiobenthos on Ship Island, Mississippi. L. W. Bennett, Vanderbilt University, Department of Biology. An investigation was conducted on two beaches of Ship Island, Mississippi to determine the influence of several physical and chemical parameters on the depth of occurrence and horizontal distribution perpendicular to the waterline of several intertidal meiobenthic metazoa. Landward, their distributions were limited by the low salinities occurring in the backbeach and by the dryness and temperature extremes of the surface sands. Seaward, they may be limited by turbulence associated with wave action. Depth of distribution was limited

by very low oxygen diffusion rates occurring at greater depths. Within the most favorable intertidal regions, each species was characteristically influenced by the median sand grain size and percent of sand less than 0.250mm diameter.

Leeches of the Stones River Drainage Area in Middle Tennessee. Steve D. Maloney, Middle Tennessee State University. Leeches were collected from September 1972 through September 1973 at 68 sites in the Stones River drainage area. These collections yielded eight species representing two orders (Rhynchobdella and Arhynchobdella) and four families (Glossiphoniidae, Erpobdellidae, Hirudinidae, and Piscicolidae). The eight species and the number of sites at which each occurred were: *Placobdella ornata* (30), *Placobdella parasitica* (14), *Helobdella lineata* (4), *Helobdella elongata* (2), *Erpobdella punctata* (1), *Haemopsis marmorata* (1), *Ilinoebdella moorei* (18), and *Ilinoebdella alba* (1). Five species (*P. ornata*, *H. lineata*, *H. elongata*, *E. punctata*, and *H. marmorata*) are new reports for Tennessee. *Haemopsis marmorata* was the only species not found in association with one or more of the other species.

The Tardigrada (Water-Bears) of Roan Mountain. Diane R. Nelson, East Tennessee State University. An investigation of the Tardigrada on Roan Mountain was conducted to determine the species of tardigrades present, their distributions on the mountain, and the possible environmental factors influencing their distribution. Twenty-one species of tardigrades, representing six genera, were identified from epiphytes on the bark of beech trees at altitudes of approximately 4000, 5000, and 6000 feet on both the north and the south slopes. At one station, a comparison was made of the tardigrade fauna inhabiting mosses on beeches, buckeyes, and sugar maples.

Development of the Tarsal Elements of *Drosophila* Legs. D. B. Benner, East Tennessee State University. The primordial discs of the developing leg evaginate in a telescoping fashion during the pupal developmental stage in *Drosophila*. By implantation of disc fragments, Schubiger (Arch. Entwicklungsmech. Organ. 160:9-40, 1968) has constructed an "anlageplan" which shows the relative positions of the developing regions of the coxa, trochanter, femur, and tibia. The absence of unique bristle patterns makes this approach unsuitable for similar determinations in the distal tarsal regions. In flies of the genotype *ci*W/O* and *T(Y:4F)/O* the tarsal elements frequently fail to elongate, but there is sufficient bristle development and segment differentiation to allow the identification of the five presumptive tarsal elements. Based on the structure of these elements, a model of relative position and unfolding of the tarsal elements will be presented.

Acid Pollution in Wilderness Streams: Great Smoky Mountains National Park. By Eric L. Morgan, Department of Biology and Tennessee Cooperative Fishery Unit, Tennessee Technological University; Ron. D. Jones, Bureau of Sport Fishery and Wildlife, Great Smoky Mountain National Park. Acid pollution has been identified in three Great Smoky Mountains National Park streams: 1. Beech Flats Creek 2. Noland's Creek and 3. Walker's Prong Creek. Naturally exposed pyritic materials in the stream bed base rock (Anakeesta) formation as the source of acid pollution in Walker's Prong, and drainage from road cuts through the formation and associated land fills as the contributing factor to acid pollution in Beech Flats and Noland's are discussed.

Preliminary findings of monthly surveys from June through October, 1973, showing adverse alterations in the macrobenthic community structure and water quality are described. Evidence of stress factors other than pH alone, i.e. heavy metals and combined effects, is presented. Support is given to the assumption that down stream drift of organisms from non-polluted sources is a major factor in recolonization.

This work was supported by funds provided by the Department of the Interior, National Park Service, Southeast Regional Office.

The Use of Manometric Techniques in Screening Potentially Environmental Hazardous Materials. By Richard C. Young, Department of Biology Tennessee Technological University Cookeville, Tennessee—Chief Biologist, AWARE, Inc., Nashville, Tennessee; Eric L. Morgan, Department of Biology Tennessee Technological University, Cookeville, Tennessee. Poten-

tially environmental hazardous materials, such as, pesticides, heavy metals, and certain industrial wastewater constituents, have recently become the object of extensive research by aquatic biologists and toxicologists.

Respiration or cellular oxidation, is common to all life forms and therefore an excellent parameter in monitoring biological systems. Warburg, 1926 developed a device based on manometric principles, which followed the rate of oxygen utilization from a closed system. Using this basic technique, hazardous materials were tested using heterogenous bacterial cultures, and homogenized fish tissue as biological indicators. These data were then evaluated by respiration rate plots as suggested by Genetelli, et al, 1971. The compounds tested were classified as either non-toxic (biodegradable), non-toxic (nonbiodegradable), variable (non-toxic biodegradable at low concentrations but toxic at higher concentrations), or toxic at all levels tested.

Vertical Distribution of Total Suspended Solids and Selected Physical and Chemical Parameters in a Thermally Stratified Reservoir. Richard S. Austin, Department of Biology, Tennessee Technological University, Cookeville, Tenn. Chemical, physical, and diurnal biomass dry weight analyses of the epilimnion, thermocline, and hypolimnion were performed on Center Hill Reservoir during August 1973. Plankton did not show a sustained high density in the thermocline but rather supported the assumption of diurnal plankton migrations. Light penetration was insufficient for supporting photosynthesis in the lower thermocline and hypolimnion necessary to maintain a positive oxygen balance. Chemical and physical analyses portrayed a rapid depletion of D.O. in and immediately below the thermocline with definite chemical-physical stratification.

ZOOLOGY SECTION II

STEVENSON, 1312

RALPH E. SHARP, *Chairman*

The Effects of Marijuana and Selected Components on the Laboratory Mouse. R. D. Ikenberry, East Tennessee State University (25 min.)

Group Learning in the Goldfish. Judith L. Warren, Rodney C. Bryant, Frederick Petty, and William L. Byrne, Brain Research Institute, University of Tennessee Medical Units, Memphis (10 min.)

Identification of *Peromyscus leucopus* Chromosomes by ASG and Q-Differential Banding Techniques. F. S. Hill and P. S. Rushton, Memphis State University (15 min.)

Bacteriostatic Activity of Transferrins of *Peromyscus*. T. A. Rhodes, M. G. Grogan, and C. J. Biggers, Memphis State University (10 min.)

A Study of a Breeding Population of American Toads, *Bufo americanus*, on Short Mountain, Cannon County, Tennessee. John L. Lewis, Jr. and George G. Murphy, Middle Tennessee State University (15 min.)

Intermission (10 min.)

Plasma Esterases of *Peromyscus leucopus* and *Peromyscus gossypinus*. J. M. Dickson, C. J. Biggers, and N. A. Miller, Memphis State University (10 min.)

Plasma Esterase Polymorphism in *Peromyscus polionotus*. W. S. Emery, C. T. Peck, and C. J. Biggers, Memphis State University (10 min.)

An Unusual Pathology Associated with the Infection of

Pseudemys scripta troostii (Holbrook) by *Camallanus trispinosus* (Leidy). D. M. MacDonald and R. G. Litchford, The University of Tennessee, Chattanooga (10 min.)

Techniques for Evaluating Hydrostatic Pressure Effects on Small and Larval Fishes. Rickey B. Walker, Tennessee Cooperative Fishery Unit (10 min.)

Asiatic Clam (*Corbicula manilensis* Philippi): Densities, Size Distributions and Substrate Preferences in Dale Hollow Reservoir, Tennessee. Tom M. Abbott and Eric L. Morgan, Tennessee Technological University (12 min.)

Worm Infections in Tennessee: Preliminary Survey by Questionnaire. Arthur W. Jones. The University of Tennessee, Knoxville (5 min.)

Improved *in vitro* System for the Study of *Trypanosoma lewisi*. Ernest W. Fuson, The University of Tennessee, Knoxville (10 min.)

The Effects of Marihuana and Selected Components on the Laboratory Mouse. R. D. Ikenberry, East Tennessee State University. Laboratory white mice were used as experimental subjects to determine the effect of marihuana smoke, crude marihuana extract, delta-9-tetrahydrocannabinol, and delta-8-tetrahydrocannabinol on food and water consumption, as well as, specific activity patterns.

Four groups of 21 male mice were treated with the selected drugs. An equal number of animals were used as controls and another group was treated with placebo marihuana smoke. Treatments were made daily through five consecutive days.

Activity patterns were determined by monitoring the following activities continuously through each 24 hour period: grooming, sleeping, feeding, drinking, total time in nest, total time out of nest, and exercising. Both duration and frequency of each activity were recorded. Prior to treatment, oxygen consumption was determined for each animal. Daily measurements of food and water were taken.

The plethora of data being analyzed at this time precludes a systematic listing of results, however, each component of marihuana shows an effect on specific activity patterns and on food and water consumption.

Group Learning in the Goldfish. Judith L. Warren, Rodney C. Bryant, Frederick Petty, William L. Byrne. Goldfish (*Carassius auratus*) were trained in a shuttlebox for ten days to avoid the dark in groups of either 1, 2, 5, 10 or 15. Individual fish made fewer correct avoidances than fish in groups on all days. Retention testing of individual fish from each size group did not reveal any significant differences in the final level of performance. In another experiment, ten experimentally naive goldfish were trained for eight days with either one or two naive or previously trained fish. "Leader" fish were scored separately. No differences in group avoidances were found due to number or pretraining of leaders. Groups with trained leaders performed slightly better than controls on day 1, less well on subsequent days of training. The present results are discussed with reference to Welty's work (*Physiol. Zool.* 7: 85-128, 1934) on group effects on learning in the goldfish.

Identification of *Peromyscus leucopus* chromosomes by ASG and Q-differential banding techniques. F. S. Hall and P. S. Rushton, Memphis State University. *Peromyscus* has been used extensively in studies of karyotype evolution. Until recently, chromosome identification for karyotype analysis was based on chromosome size and location of the centromere. The development of chromosome banding techniques has provided an accurate means for detailed identification of chromosomes. Two of these differential banding techniques, ASG and quinacrine banding were used on chromosome preparations from two male mice of the species *Peromyscus leucopus*. Bone marrow cells were collected twenty-four hours after bleeding to induce division. Homologous chromosomes were matched for karyotyping on the basis of

their differential banding in addition to chromosome size and location of the centromere. An unusual finding was the appearance of secondary constrictions and satellites on the short arms of several of the small metacentric chromosomes. Chromosome polymorphism is common in *Peromyscus leucopus* and the differential banding patterns facilitate matching of homologous chromosomes for karyotyping particularly in cases where these homologous chromosomes exhibit some morphological variations.

Bacteriostatic Activity of Transferrins of *Peromyscus*. T. A. Rhodes, M. G. Grogan, and C. J. Biggers, Memphis State. Transferrin, a beta-globulin found in the serum of man and many other vertebrates, performs a variety of functions in the body relating to its ability to bind and transport ionic iron. Evidence has been presented that transferrin also functions as a non-specific immunity factor in the serum by making iron unavailable for microbial growth. In this study the bacteriostatic activity of serum from three species of mice, *Peromyscus leucopus* P. polionotus, and P. maniculatus was studied *in vitro*. *Klebsiella pneumoniae* was grown in serum saturated with ferric chloride. It was found that the addition of iron markedly reduced the bacteriostatic activity of the serum, although the effect varied among the three species of mice. This reduction of bacteriostatic activity may result from iron-saturation of serum transferrin. At present work is being done to determine if any significant bacteriostatic differences exist between the specific transferrin genotypes in P. polionotus.

A Study of a Breeding Population of American Toads, *Bufo americanus*, on Short Mountain, Cannon County, Tennessee. John L. Lewis, Jr. and George G. Murphy, Middle Tennessee State University. A breeding population of the american toad, *Bufo americanus*, was studied during the spring of 1971, 1972 and 1973. Growth rates, sex ratios, population size and factors influencing time of breeding were studied. Four hundred and ninety-five mature toads were marked by toe clipping for individual identification. Average size of breeding males and females was 71.4 mm and 81.2 mm respectively. Males captured at the breeding pond greatly outnumbered females (3.9 to 1 ratio). This apparently reflects a combination of differential arrival dates, periods of stay at the breeding pond, and biased sampling due to the conspicuousness of calling males. Individuals appeared to return year after year not only to a particular pond, but to a particular site within the pond.

Plasma Esterases of *Peromyscus leucopus* and *Peromyscus gossypinus*. J. M. Dickson, C. J. Biggers, N. A. Miller, Memphis State University. Acrylamide gel electrophoresis was used on blood plasma of field caught *Peromyscus leucopus* and *Peromyscus gossypinus*. Both general protein and serum esterase patterns were obtained after horizontal slicing of the gel. The results of the serum esterase patterns were compared with previous reports on *Peromyscus leucopus* from different localities. One of the objectives of this study is to provide information on specific identification of the two closely related sympatric species *Peromyscus leucopus* and *Peromyscus gossypinus*.

Plasma Esterase Polymorphism in *Peromyscus polionotus* W. S. Emery, C. T. Peck, and C. J. Biggers, Memphis State University. A comparison of plasma esterases of *Peromyscus polionotus* from existing stock previously collected from Mississippi, Florida, and South Carolina was made using vertical polyacrylamide gel electrophoresis. Three distinct regions of esterase activity were identified by specific stains and designated I, II, and III (cathodal to anodal). Region I exhibited three variants which were present in mice from all three states. Region II also exhibited three variants, only one of which was seen in the Mississippi mice. In Region III, there are four levels of migration designated as A-D. C and D were only observed in the Mississippi mice. Since these esterase variations appear in different geographic locations, they are of considerable interest in studying the evolutionary development of the species.

An Unusual Pathology Associated with the Infection of *Pseudemys scripta troostii* (Holbrook) by *Camallanus trispinosus* (Leidy). D. M. MacDonald and R. G. Litchford, The University of Tennessee at Chattanooga. A single female *Pseudemys scripta troostii* (carapace length of 23 cm.) from a group of autopsied Cumberland turtles carried a usual worm burden at the time of autopsy. Intestinal parasites included *Camallanus trispinosus*; *Neoechinorhynchus pseudemydis* (Cable

et Hopp); *Polystoma orbiculare* (Stunkard); *Spironoura chelydrae* (Harwood); and *Spiroxyis contioris* (Rud.). Several *C. trispinosus* individuals were recovered from cyst-like structures in the pancreas. Conditions of the pathology will be presented.

Techniques for Evaluating Hydrostatic Pressure Effects on Small and Larval Fishes. By Rickey Butch Walker, Department of Biology, Tennessee Cooperative Fishery Unit, Tennessee Technological University, Cookeville, Tennessee 38501. Hydrostatic pressure has affected fishes since the existence of hydroelectric installations. In this study, hydrostatic pressure was evaluated to develop techniques for analyzing pressures effects on small and larval fishes. The pressure vessels designed for this study were made of Pyrex glass cylinders with metal end plates. The vessels were tested with a maximum operating hydrostatic pressure of 250 psi and were found to be satisfactory. Small bluegill, *Lepomis macrochirus* Rafinesque; largemouth bass, *Micropterus salmoides* (Lacepede); and channel catfish, *Ictalurus punctatus* (Rafinesque) were subjected to 200 psi for no more than 10 seconds. After three days observation, no mechanical damage or mortality was observed in the largemouth bass and channel catfish. Equal mortality was 35% for both test and control bluegill.

Asiatic Clam (*Corbicula manilensis* Philippi): Densities, Size Distributions, and Substrate Preferences in Dale Hollow Reservoir, Tennessee. Tom M. Abbott and Eric L. Morgan, Department of Biology, Tennessee Technological University, Cookeville, Tennessee 38501. *Corbicula* clams collected at 8 meters depth (Zone I) and 14 meters depth (Zone II) using SCUBA gear and a Surber sampler were tested statistically for homogeneity of variance for shell length, height, width, and weight. Results confirmed the hypothesis that aggregations within these belts were characterized by a uniform frequency and similar age structure, also characteristic of *Dreissena polymorpha* as reported by Stanczykowska, 1964.

The upper Zone (I) coincided with a belt-like area just above the thermo cline of a blue-green algae, *Oscillatoria*, attached to a rocky substrate. Based on length frequency, 86% were of age group III and multiple samples showed a density of 379/m². There was no significant difference in any of the 10 paired t-tests (p > .05 for all pairs) for width and only one of the 10 paired tests was significant at p > .05 for length.

The F-ratios for mean difference between Zone I and Zone II showed significant differences at the .01 confidence level for length, height, width, and shell weight.

Worm Infections in Tennessee: Preliminary Survey by Questionnaire. Arthur W. Jones, University of Tennessee, Knoxville. Questionnaires mailed to 100 physicians throughout Tennessee resulted in 41 replies. Pinworms, ascaris, and whipworms were mentioned in large enough numbers to give an indication, based on diagnosis or treatment for these parasites over the past ten years, that pinworms are prevalent in metropolitan and urban areas, while ascaris is relatively common in rural areas. Geographically, the ridge-valley region (East Tennessee) appears to have more worm infections than the central basin or the Mississippi plain areas. Trichuris is present all across the state, but rarer than the other worms. The response to the questionnaire was extremely good, in my opinion, justifying further use of this survey method.

An Improved *In Vitro* System For the Study of *Trypanosoma lewisi*. Ernest W. Fuson, University of Tennessee, Knoxville. D'Alesandri (1962) reported an *in vitro* system in which *Trypanosoma lewisi* multiplied for 24 hours and could be maintained for 48 hours. In the present medium—consisting of Hank's BSS, glucose, peptone, rat serum, and rat erythrocytes—the trypanosomes multiplied for 96 hours and were maintained for 168 hours. The trypanosomes grown in this medium were susceptible to 7S and 19S trypanocidal antibodies and ablastin, and were infective to the rat host. The ablastic effect was demonstrated by a decrease in the percentage of reproductives and inhibition of reproduction of the population. The system was used to study the effects of cAMP on the reproductive rate of blood stream forms.

COLLEGIATE DIVISION
SATURDAY, NOVEMBER 17, 9:00 A.M.
STEVENSON CENTER, 4309

RICHARD J. RARIDON, Chairman

A Histological Study of Leg Abnormalities Associated with Y-4R Translocation in *Drosophila*. G. S. Queen, East Tennessee State University (20 min.)

An Ecological Study of a Duck Pond in White Oak, Tennessee. I. Trematoda Fauna. Steve Twitty, The University of Tennessee, Chattanooga (20 min.)

A Cigarette Smoking Machine Design for Cardiovascular Research. Steven B. Cliff, The University of Tennessee, Knoxville (20 min.)

Experimental Laboratory Procedure on Bacterial Conjugation and the Lactose Operon in *Escherichia coli*. Wanda Patrick, Diane M. Turner and Lane P. Lester, The University of Tennessee, Chattanooga (20 min.)

A Histological Study of Leg Abnormalities Associated With Y-4R Translocation in *Drosophila*. G. S. Queen, East Tennessee State University. *Drosophila* carrying a Y-4R translocation show many leg abnormalities including fusion of joints, extra bristles, and evaginated and invaginated growths. It was concluded that evaginated growths were cuticular in structure due to the presence of bristles on the growths. However, the invaginated growths were not as readily observed and deciphered. It became necessary to make histological studies using eosin and hematoxylin stains in order to detect the structure of these growths. The invaginated growths were concluded to be cuticular due to their standing qualities.

An Ecological Study of a Duck Pond in White Oak, Tennessee. I. Trematoda Fauna. Steve Twitty, The University of Tennessee at Chattanooga. A continuing study of gastropod intermediate hosts has included the autopsy of 1050 specimens of *Physa* spp. and *Lymnaea* spp. The complete life-cycle of *Notocotylus attenuatus* (Rud., 1809) has been demonstrated. Several un-described larval forms have been recovered and will be presented.

This report establishes *Physa* spp. as a new intermediate host for larval *Notocotylus attenuatus*.

A Cigarette Smoking Machine Design for Cardiovascular Research. Steven B. Cliff, The University of Tennessee. A device for the exposure of rats to cigarette smoke was designed and built for use in a cardiovascular research program being conducted by Dr. T. P. McDonald at the University of Tennessee Memorial Research Center and Hospital. The device was designed and built through the Department of Engineering Science and Mechanics at the University of Tennessee in Knoxville by the author. The device follows the stringent standard smoking conditions, while providing the full degree of freedom which the standards allow. During its design and construction, the inevitable problems of economics and logistics arose, requiring careful attention to produce a design which would be functionally correct, yet be as easy as possible to construct.

Experimental Laboratory Procedure on Bacterial Conjugation and the Lactose Operon in *Escherichia coli*. Wanda Patrick, Diane M. Turner, and Lane P. Lester, University of Tennessee at Chattanooga. The Lactose Operon is a genetic system found in the DNA of *Escherichia coli*. This genetic system codes for two enzymes (β -galactosidase and a galactoside permease) that are essential specifically for the metabolism of lactose. The genes work in such a way as to produce these enzymes only when they are needed by the bacterium (except in the case of gene mutations).

Gene recombination in *Escherichia coli* occurs by conjugation which is a process of sexual reproduction in unicellular organisms.

These two characteristics of *Escherichia coli* are combined into an experimental laboratory procedure to be used by the genetic student in order to enhance his understanding of both bacterial conjugation and the lac operon.