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ABSTRACTS PRESENTED AT THE ANNUAL MEETING

BOTANY SECTION

JOHN W. HARRIS, *Chairman*

Host Specificity of Mistletoe in Middle Tennessee. THOMAS E. HEMMERLY and S. K. CLEARY. Middle Tennessee State University.

Phoradendron flavescens, the common mistletoe of southeastern United States, has been found to infest preferentially various species of trees within its range. Recent surveys of 13 counties in the Central Basin and one county on the Highland Rim of Middle Tennessee resulted in the finding of 37 host tree species. The most frequent host species were American elm, slippery elm, September elm, shagback hickory, black gum and white ash. Some possible explanations for the host-specific parasitism were discussed.

Azolla mexicana Presl., A Slow-Growing Species of *Azolla.* VERNON M. BATES, JR. and EDWARD T. BROWNE, JR. Memphis State University.

Azolla is the only known fern to live in symbiosis with a nitrogen-fixing organism. Much information about nitrogen metabolism can be obtained from this type of relationship. Even though this symbiosis plays an important role in the nitrogen cycle, it may at the same time cause problems with the taxonomic treatment of the genus *Azolla.*

Comparison of typically smaller fronds of *A. caroliniana* Willd. with the typically larger fronds of *A. mexicana* Presl., indicates that the latter is a slower growing species The maturation and elongation of the roots of *A. mexicana* occur in a limited ventral region near the apex, with the roots falling off immediately after maturation. For *A. caroliniana,* root maturation and elongation requires the full length of the ventral surface, with the roots falling off only as the leaf lobes decay. This apparent difference in root growth may be determined by the activity of the phycobiont.

The Effects of Auxins, Cytokinins, and Carcinogens on Leaf Development in Cinnamon Fern. JAMES D. CAPONETTI, The University of Tennessee, Knoxville.

Experiments on the effects of several mammalian carcinogens on cinnamon fern leaf development in sterile culture have thus far shown that some inhibit leaf growth when compared with controls, some stimulate growth, and some have no differential effect. In no case did leaves produce callus tissue or tumorous growths. Since the induction of callus in tobacco stem pith and in carrot root phloem by certain auxins and cytokinins is well known, cinnamon fern leaf primordia were cultured on media containing various auxins and cytokinins alone and in combination with several previously tested carcinogens. Of the auxins tested, only 2,4-D induced a callus-like growth of the basal portion of the petiole. Subcultured callos died. None of

the cytokinins tested induced callus. Of the leaves exposed to several combinations of auxins, cytokinins, and carcinogens, only the combination of 2,4-D and an aflatoxin induced slight callus formation. The subcultured callus died.

Seedling Growth of PHARBITIS NIL. HAROLD A. SIMMONS, Union University.

Pharbitis nil Violet is a twining vine containing abundant endogenous gibberellin (GA), and strain Kidachi is a dwarf mutant with little or no endogenous GA. Seeds of both strains were scarified, aerated for 12 hours in distilled H_2O, 10^{-4} M GA, or 10^{-4} M abscissic acid (ABA), and planted in 1:1 vermiculite and soil. Hypocotyl measurements were recorded ten days after planting.

	Hypocotyl length (mm ± standard error)		
	Control	GA	ABA
Violet (=normal)	80.9 ± 1.9	93.9 ± 2.7	91.0 ± 3.8
Kidachi (=dwarf)	45.6 ± 1.0	54.0 ± 1.3	53.8 ± 1.4

ABA is considered an inhibitor, yet above data indicate a stimulation occurs in *Pharbitis nil*. Since the dwarf strain is GA deficient, the stimulatory effect by GA was expected. However, stimulation by ABA was observed but definitely not expected. These data support the proposal that ABA and GA may have mutual steps in a biosynthetic pathway.

Inhibition of Pigment Formation in a Pigmented, Asporogenous Mutant of Bacillus cereus by Hexose Sugars. THEODORE E. SNAZELLE, The University of Tennessee at Nashville.

Production of orange pigment in colonies of *Bacillus cereus* (GCRL — 29) grown on Difco Marine Agar 2216 is inhibited by the medium incorporation of any of the following hexose isomers: 0.5% glucose (5 g/liter),, 0.5% mannose, or 0.5% fructose. Also, pigment production was inhibited by the disaccharides maltose (0.5%) and sucrose (0.5%) which are composed of glucose (maltose) and glucose plus fructose (sucrose). Galactose, a stereoisomer of glucose, did not inhibit pigment formation. Thus, the only hexose sugars which will inhibit pigment formation are those with identical structures for carbon atoms C_3, C_4, C_5, and C_6.

Replication Studies of Streptococcus cremoris *Bacteriophage in Abnormal Host Cells.* W. H. FARLEY, Tennessee Technological University.

This research was to investigate whether or not *S. cremoris* phage F-2 could replicate in hosts other than its natural bacterial host. Embryonating hen eggs, Rhesus monkey kidney tissue, chick fibroblasts, and *Tetrahymena pyriformis* served as the abnormal hosts. Various routes of inoculations and varying ages of embryoes were employed. Both intact phage which was purified by ultracentrifugation and sephadex column and extracted DNA which was obtained by the Freifelder technique were used as inoculums. The number of phase present was determined by the plaquing technique involving the overlay method.

Phage was shown to persist for long periods of time in the abnormal hosts, but no cytopathic effects (CPE) were observed. Slight increases in phage titers were obtained at times but never a two-log increase which is considered to be significant. Mankiewicz and others have shown that some phages will produce CPE and replicate in abnormal hosts.

Alternatives in Pest Management. G. VREDEVELD, R. BULLARD, M. SELLS, S. SIMS, B. WEST, The University of Tennessee at Chattanooga.

Deleterious effects of chemical pesticides on many plant and animal populations have been described. Rapidly increasing costs of convenient energy sources has increased cost-benefit ratios of chemical pesticides used. We compared biological control techniques versus chemical pesticides as to inputs of human labor, machinery, and fuel per hectare at each pertinent step of the cultivation procedure. We selected three pest-crop systems and converted all applicable factors into Kcal. of energy required. The three are 1) Citrus-red scale *(Aonidiella aurantii)* using oil as a chemical or the predator wasp *(Aphytis melins)* as a biological control, 2) Greenhouse cucumbers-white fly *(Trialeurodes vaporariorum)* using Orthene or the wasp *(Encarsia formosa)*, 3) Tomato-hornworm using Seven or the bacterium *(Bacillus thurengiensis)*. For citrus-red scale, the pesticide required 14,864,000 Kcal., the use of *A. melinus* 119,000 Kcal.; for cucumber-white fly the pesticide 98,544, *E. formosa*, 33,500; for tomato-hornworm the pesticide 87,903, *B. thurengiensus* 39,824 Kcal.

Distribution of Reported Algal Indicator Species in a Copper Mining District. MARK SHEARON, Harmon Engineering and Testing Co., Inc., Huntsville, and ERIC L. MORGAN, Tennessee Technological University.

A survey of the periphyton algae of the Ocoee River in the vicinity of Cities Service Company, Copperhill Operations, was initiated in September, 1976 and continued until June, 1978. A modification of the Patrick Catherwood diatometer was used to collect periphyton on a monthly regime. Analysis of the species collected revealed a pattern of dominance of several algae previously reported as indicators of heavy metal and mining industry associated pollution. These algae included *Stigeoclonium tenue, Nitzschia* spp., and *Microthamnion strictissimum*. Seasonal patterns of abundance of these algae above and below the industry will be discussed, along with comments on the previous literature on their pollution tolerances.

This research was conducted under a Fellowship Grant from the Cities Service Company, Copperhill Operations and the Aquatic Ecology Research Fund of the Environmental Biology Research Center, Tennessee Technological University.

Effect of Indole-3-Acetic Acid on CHLORELLA PYRENOIDOSA. M. I. ALAM, LeMoyne-Owen College.

High temperature strain of *Chlorella pyrenoidosa* was grown in Bristol's medium at 39 C to study the effects of exogenously applied indole-3-acetic acid (IAA) and two other phytohormones. Enhancement in the growth and DNA contents of the cells was noticed by 1.0 μg/ml treatment of IAA. Such enhancement was accompanied by the intake of 14c- labelled IAA by growing cells. Comparative data on the effects of IAA on *Scenedesmus quadricauda* are discussed.

CHEMISTRY SECTION

ROBERT G. ZIEGLER, *Chairman*

The Synthesis and Chemistry of Cyclopentano [h] Isoquinoline and Derivatives. WILLIAM E. SOLOMONS, The University of Tennessee at Martin.

Abstract: During the course of a project to produce a new antihypertensive drug, various cyclopentano [h] isoquinolines and cyclopentano [h] and cyclopentano [f] trahydroisoquinolines were synthesized. The focal point of this discussion will be the synthesis of 5,6-dimethoxycyclopentano [h] isoquinoline and some of its chemistry.

Solvolytic Reactions With 2-anilinotetrahydropgran. ROBERT T. SWINDELL and SHABHA WAYKOLE, Tennessee Technological University.

The aldehyde 5-hydroxypentanal, which exists primarily in the cyclic hemiacetal form, has been reacted with aniline, p-toluidine and x-phenyl ethyl amine to produce aminotetrahydropgrans. Preliminary investigation of the soluolytic behavior of the former two compounds has been initiated.

A Proposed Mechanism for the Transannular Cyclization of Cyclodecyn-6-one. C. E. HARDING and RICHARD STANFORD, The University of Tennessee at Martin.

Cyclodecyn-6-one is rearranged by both mineral and Lewis acids to give an isomeric α,β-unsaturated octalone in high yield. Conditions for the rearrangement will be discussed. The mechanism of the cyclization is rationalized in terms of a concerted, six-membered ring transition state.

PREPARATION OF IMMOBILIZED INVERTASE. DR. THURSTON E. BANKS and CECIL HORNE, Tennessee Technological University.

Invertase, (β-fructofuranosidase) has been the subject of numerous studies during the past few years involving attempts to prepare and evaluate the enzyme immobilized in or on a solid support. This study initiates work with Invertase and the solid support Sepharose 4B.

Covalent attachment of the enzyme to Sepharose 4B was achieved. The matrix was first activated with cyanogen bromide and the enzyme was then coupled to it through the ε-amino group of a lysine residue. The immobilized Invertase effected hydrolysis of the substrate sucrose and retained 8% of its activity after 4.5 months.

Precision Grading of General Chemistry Laboratory Experiments by Computer. D. B. STONE, The University of Tennessee at Martin.

A set of three BASIC language programs has been written to grade student papers for the eighteen numerical experiments in *Laboratory Manual for College Chemistry*, by W. T. Smith, Jr., J. H. Wood, and W. E. Bull. Each paper is graded for 1) the accuracy of the student's calculation (based upon his own data), and 2) the accuracy of the student's experimental data (based upon the correct value for the sample or unknown). After the instructor enters a yes-or-no observation regarding neatness and significant figures, the program assigns a grade. After the last paper in a section, a list of student names and scores is printed. After the last paper of the week, the programmer can ask for a list of answers (calculated correctly but based upon student experimental data) so that the overall quality of the experimental work can be assessed.

ENGINEERING SECTION

HALL C. ROLAND, *Chairman*

Research Participation Programs at Department of Energy Facilities. A. WOHLPART, Oak Ridge Associated Universities.

Oak Ridge Associated Universities, a not-for-profit corporation of 45 colleges and universities, administers for the Department of Energy research participation and lecture programs. The purpose of these activities is to provide channels of cooperation and communication between colleges and universities on one hand and Department of Energy laboratories and technology centers on the other.

Opportunities are available for faculty members, graduate and undergraduate students in the physical, life, and social sciences; mathematics and engineering fields to participate in the on-going research and development at fourteen Department of Energy facilities for either short or long terms. A faculty rotator program at the Fossil Energy Headquarters provides the opportunity to participate in program planning and review. Under the auspices of the Travel Lecture program, personnel from Department of Energy facilities and universities visit campuses to present lectures and seminars and to participate in colloquia.

Heat Transfer Bench Test For The OC-5 Graphite Creep Test Capsule. DR. HALL C. ROLAND, University of Tennessee at Knoxville.

The OC-5 Graphite Creep Test Capsule is one of three graphite creep test capsules which are to be irradiated at the Oak Ridge National Laboratory. This capsule, which will undergo neutron irradiation in the Oak Ridge Research Reactor, is to operate with the graphite specimens at 1250 °C. Because of the high temperature required, several significant modifications had to be made to the basic design of the lower temperature capsules. These included the removal of temperature control heaters and the inclusion of a thermal radiation shield in the form of a tungsten cylinder around the graphite specimens.

Loss of the heaters for temperature control and uncertainty as to the value and constancy of the radiant emmissivity of the tungsten cylinder dictated an experimental testing of the heat transfer calculations. A bench test has been designed and is in operation to verify the heat transfer calculations and to determine the constancy of the emissivity of the tungsten in the same atmospheric and thermal conditions as the actual irradiation capsule. Design and operation of the bench test is described and results are given up to the present.

Design of the HRB-15b Coated Particle Irradiation Capsule. BRIAN JOHNSEN* and HALL ROLAND, University of Tennessee at Knoxville.

The HRB-15b experiment is to test seven batches of fissile coated particles and six batches of fertile coated particles for possible use as fuels in future High Temperature Gas Cooled Reactors. Irradiation to a total neutron exposure of 8.0×10^{21} n/cm² (E<0.18 Mev.) is to be at an average temperature of 1000 °C (1832 °F). The design required the arrangement of the fissile and fertile particles so as to obtain approximately the same average power generation rate as fissile fuel burned out and was replaced by fuel produced in the fertile particles. This was done by alternating fissile and fertile particles in thin graphite disks, and smearing the power produced over a two disk region. Two dimensional heat transfer calculations using the HEATING V code enabled the prediction of required capsule dimensions and loading to obtain the necessary temperature. This code was also used to find the relationship between the particle temperature and the graphite disk temperature at different particle powers.

A one dimensional code, GENGTC, was used to compare disk temperatures at different times in the reactor power cycle and for different radiation cycles of the particles.

Initial results for the operation of the capsule are reported.

A Thermal Hazard Associated with the Use of Cellulose Insulation. DAVID W. YARBROUGH, Tennessee Technological University.

The use of loose fill cellulosic insulation around recessed light fixtures has been shown in some cases to be a potential fire hazard. Recessed light fixture temperatures have been measured for a variety of operating conditions to determine situations in which a fire hazard exists. Fixtures covered by insulation and operated at excess power levels were found to be prime candidates for fire.

GEOLOGY-GEOGRAPHY SECTION

WALTER L. HELTON, *Chairman*

Landsat 3: New Tool for Geographic Analysis. R. O. FULLERTON, Middle Tennessee State University.

In March of 1978 a new instrument for geographic analysis became available. This instrument, known officially as Landsat 3, has as its basic mission the remote sensing of the earth's surface through five spectral bands. There are two basic remote sensing systems in Landsat 3, the Return Beam Vidicom (RBV) and the Multi-Spectral Scanner (MSS).

Unlike Landsat 1 and 2, Landsat 3 cameras view adjoining squares of surface, 53 nautical miles on each side. The use of a longer focal length allows a greater resolution and sharper detail in the pictures and permits Landsat 3 to provide information for detailed ground mapping.

In early 1982 Landsat "D" will be launched. This satellite will contain a six band scanner and will provide for data analysis into more detailed classes. It will provide for a greater array of algorithm implementation and processing.

Contrasting Cementation Between Shallow and Deep Marine Limestones: DSDP Site 401. DAVID N. LUMSDEN, Memphis State University.

Sediment type abruptly changed downhole from very fine grained, deep marine, Campanian, nannofossil chalk to coarse grained (pebble and granule), shallow marine reefal, limestones of lower Cretaceous age at 247 meters subsea floor. Cementation in the chalks was carbonate conservative with etching of the 1-10 micron calcite coccoliths supplying all the material for the precipitation of 1-5 micron calcite overgrowths on adjacent grains. Mass balance estimates indicate that no external supply of calcite is necessary and that the downhole decrease in chalk porosity is therefore due to compaction not cementation. In contrast the large voids in the porous (30-50%) reef-like limestones are wholly or partially filled with visibly crystalline calcite spar (blocky and fibious) derived from intergranular solutions that brought the cement material from outside the rock body. Cement texture indicates that both vadose and phereatic cements are present. Evidence for compaction in the reefal limestones is minimal.

Origins of the Accessory Minerals in Unconsolidated Paleogene Sands in Western Tennessee. ARMIN L. CLARK, Murray State University.

Accessory minerals in the Wilcox and Claiborne (Eocene) Formations from the northeastern part of the Mississippi embayment in western Tennessee were studied to determine their origins. Samples from 52 sites were examined. Approximately 300 grains of each sample were identified. The two formations contain the same heavy minerals, namely ilmenite, leucoxene, zircon, kyanite, tourmaline, staurolite, and rutile. The ultimate source of most of the accessory minerals from both formations is the uplifted and eroded igneous and metamorphic rocks of the southern Appalachian Mountains. Nearby Paleozoic sedimentary rocks derived from the northern Appalachians and nearby Cretaceous and Paleocene coastal plain formations are considered minor sources.

MATHEMATICS SECTION

"Probability Analysis of Match Systems for World Chess Championship." PAUL LAWRENCE, Dyersburg State Community College.

In 1975 Robert Fischer resigned his title as Chess Champion of the World in a dispute with FIDE, the world chess organization, over the match rules for the upcoming title defense. Fischer insisted that the match rules under which he won the title should be changed. Opponents claimed that the changes he wanted would give him a greater advantage than past champions had enjoyed. Ultimately the dispute centered on this question—does the better of two players always have a higher probability of winning a match under one system than under the other. In this paper the two systems are described and then analyzed using probability theory. In the analysis, two hypothetical players, Alpha and Beta, are considered. Formulas are derived for Alpha's probability of winning a match under the two systems. These formulas are expressed in terms of the symbols A, B, and D which stand for Alpha's per game win probability of a draw respectively. Various values of A, B, and D are then tested to see if the better player is always more highly favored by one system than the other. The results show that neither system is to be preferred in all cases, and, thus, that many of the claims of both proponents and opponents of the Fischer system have been overstated.

Generalized Polygens. A. YANUSHKA, Christian Brothers College.

There is a class of finite geometries called generalized polygons. A generalized polygon with order has a restricted structure. This fact was proved by W. Fert and G. Higman. Actually a generalized polygon without order has a restricted structure. In fact, the set of thick elements of a generalized polygon forms a generalized polygon which has order.

Theorem. Let G be a nondegenerate generalized m-gon, which is not an ordinary polygon. If K is the minimum distance between pairs of thick elements of G, then K divides M.

The thick elements of G have at most two sizes, say $l + s$ and $l + t$.

If $m = kq$ for some integer q and $q > 1$, then the set of thick elements of G forms a nondegenerate generalized q-gon of order (s,t) and q is 2, 3, 4, 6, 8 or 12.

A Lesson Involving Inflation and Population Made Easier by Using a Hand-Held Calculator. ERNEST WOODARD, Austin Peay State University.

This presentation will be a description of a lesson appropriate for advanced high school and beginning college mathematics students. Social problems related to inflation and population expansion will be investigated from a compound interest and doubling time point of view. Most people find the results very surprising.

Some Properties of the Diagonal Angles of n-Dimensional Cubes. ALVIN TIRMAN. East Tennessee State University.

When the techniques of vector analysis are employed in studying the properties of n-dimensional cubes, interesting relationships among the angles formed by the intersecting diagonals emerge. Such angles provide significant algebraic structures in cubes of even dimension while in odd dimension they allow for construction of sequences of distinctive simplicity.

An Oscillation Theorem For A Second Order Superlinear Differential Equation With Delay. V. M. SAKHARE, East Tennessee State University.

Sufficient conditions are given for oscillation of superlinear differential equations of the form $y''(t) + p(t)\, y(g(t)) = 0$ with delay and functional delay equations $y''(t) + p(t)\, F(y_t) = 0$.

Baye's Formula in Probability Applied to Some Basic Finessing Problems in the Game of Bridge. JOHN KINLOCH, East Tennessee State University.

In this paper we look at the general rule of 'nine never and eight ever' with regard to the standard finessing situation and see how Baye's Formula shows when this rule of play should be ignored.

A Lesson Involving Inflation and Population Made Easier by Using a Hand-held Calculator. ERNEST WOODARD, Austin Peay State University.

The "Rule of 72" states that when money is invested at a rate of r% compounded annually, the time it takes this money to double in amount is approximately $\frac{72}{r}$. The rule can be intuitively discovered by calculating doubling times for various rates using a calculator. This was done in a lesson planned by the author. The remainder of the lesson involved an investigation of inflation and population trends using compound interest and doubling times. In the lesson it is determined that in the year 2,146, assuming a constant annual inflation rate of 6%, a $100 bicycle by today's standards will be worth more than $1,500,000 and in the year 2,515, assuming a continuing of the current world annual population increase of 2%, there will be approximately one person for every square meter of earth land surface.

MEDICAL SCIENCES—SECTION I

W. ANDREW SIMPSON, *Chairman*

Analysis of the Toxic Effects of Bromodeoxyuridine During Mouse Development. RICHARD G. SKALKO, East Tennessee State University.

Bromodeoxyuridine (BrdU) is a potent embryotoxic agent when administered to pregnant mice during the period of major organogenesis, producing exencephaly, cleft palate and a variety of limb defects in surviving fetuses. To demonstrate that these effects were related to the incorporation of BrdU into embryo DNA, two experiments were performed. In the first, hydroxyurea (HU), a DNA synthesis inhibitor, was administered to pregnant mice 1 h or 3 h before a teratogenic dose of BrdU on day 10. The first sequence produced a significant decrease in cleft palate ($P = <0.0053$ while the second resulted in an increase in syndactyly and ectrodactyly ($P = <0.005$). These results suggested that HU was producing a transient inhibition of DNA synthesis (1 h) and was acting to synchronize cells held at the G_1-S interface after the block was released (3 h). This was confirmed by analyzing the effect of HU on ^{3}H-dT and ^{3}H-BrdU incorporation into the DNA of the embryo at this stage of development.

The Effect of Δ^9-Tetrahydrocannabinol on Herpes Simplex Virus Replication. R. DEAN BLEVINS, East Tennessee State University.

Following exposure to Δ^9-tetrahydrocannabinol, inocula of herpes virus Types 1 and 2 fail to produce extensive cytopathic effect upon incubation in human cell cultures. In HSBP and WI-38 cell cultures containing 1.3 ug of Δ^9-THC/ml of medium, observable HSV-1 and HSV-2 cytopathic effect was retarded at least 75% in relation to the controls. In addition, the virus cytopathic effect of the experimental cultures appeared 24 hours later than that of the controls. An alteration of these results did not ocur when the Δ^9-THC was added 8 hours before or after virus inoculation. The rising incidence of herpes genitalis and the association of Type 2 herpes simplex virus infections of the genital tract and the development of cervical cancer stimulated this research.

Immunoperoxidase Identification of Reactive Factors in Leukemia Sera for Lymphoid Tissue. D. S. ACUFF, S. H. SMITH, H. B. NIELL, J. M. MASON, B. R. JENNINGS. University of Tennessee Center for Health Sciences.

A direct immunoperoxidase staining method was used to determine the presence or absence of reactive substances in chronic lymphocytic leukemia (CLL) patients. CLL sera was applied to normal lymph nodes, allowed to incubate one-half hour, then washed off. Peroxidase conjugated anti-human immunoglobulins were added to the lymph nodes and 3,3'-diaminobenzidene tetrahydrochloride (DAB) was then applied for several minutes to stain the nodes. For controls normal rabbit serum and human sera known to have no anti-nuclear antibodies by the method of the fluorescent anti-nuclear antibody test were used. It was found that CLL sera contains substances which react with normal lymph nodes. The pattern of staining suggests that some reactive substances are directed against the cytoplasm and others against the nuclei. Sera of some CLL patients reacted mainly with the cytoplasm whereas sera of other patients reacted mainly with the nuclei. Perhaps two classes of reactive factors exist, one directed against the cytoplasm and one directed against the nucleus. Complement levels for C_3,C_4,C_5 Proactivator, and total complement were determined.

Axonal Sprouting In The Accessory Optic System Of The Albino Rat. RONALD H. BAISDEN, East Tennessee State University College of Medicine.

In many mammalian species, retinofugal projections terminate in regions other than those associated with primary visual function. This accessory optic system (AOS) in the rat consists of a dorsal (DTN), a lateral (LTN) and a medical terminal nucleus (MTN). In most species, including rodents, these nuclei are described as receiving crossed retinal projections only. After prenatal eye removal in the rat however an aberrant uncrossed projection to MTN has been described. In the present study, one eye was removed in adult rats and the projections from the remaining eye mapped 1-3 mo. later by autoradiographic labelling following ^{3}H-fucose injection into the eye. Fucose is incorporated into glycoprotein and transported along ganglion cell axons by axoplasmic transport. In these animals clear ipsilateral projections into the MTN were demonstrated No ipsilateral projection into the other components of the AOS was observed. It was concluded that the ipsilateral projection seen here arose through axonal sprouting of a small uncrossed projection to MTN that is normally below the resolution of conventional neuroanatomic mapping procedures. These results will be discussed in regard to the anatomic organization of the AOS and mechanisms of axonal sprouting in the mammalian CNS.

A Correlation of Age With IgG-Rosette Forming Cells and Antibody-Dependent Cell-Mediated Cytotoxicity by Murine Splenocytes. J. R. FUSON, L. BEACH, and E. W. FUSON. Lee College and the University of Tennessee Memorial Research Center.

It has previously been demonstrated that IgG-antibody-dependent cell-mediated cytotoxicity (ADCC) requires effector cells that possess an IgG Fc receptor. In this study the level of cytotoxicity in IgG-ADCC and the number of IgG rossette-forming cells (RFC) present in BALB/c spleen were correlated with the age of the organ donors. In the RFC and ADCC assays the lymphocytes were prepared from the spleens of mice that were $<$ 5 days old to 700 days of age. Target cells used in the ADCC assay were ^{51}Cr-labeled, mouse IgG sensitized sheep erythrocytes (SRBC). The indicator cells in the RFC assay were SRBC sensitized with the same mouse IgG. The level of ADCC activity was directly proportional with the%RFC with very young and very old animals expressing the greatest activity in both assays.

Ascorbic Acid Protection of Mice Injected with Ricin Toxin. C. E. CLARK, Ph.D. and CAROLE WILSON, East Tennessee State University.

Ricin is a toxic lectin isolated from castor beans, a plant found throughout the South as an ornamental shrub and used as a protective agent against mole infestations. This toxic agent is know to inhibit GTP hydrolysis involved in translocating the growing polypeptide chain during protein synthesis. Previous work (J. of Nutr. Sci. and Vitaminol. 23, 475-480, 1977) showed that ascorbic acid protected HeLa cells from the action of ricin. Ascorbic acid doses ranging from 150 to 750 mg/Kg protect mice from death by ricin. The ascorbic acid appears to be most effective at a dose of 300 mg/Kg against a toxin dose of ½ the LD_{100}. Ascorbic acid affords no protection for ricin doses equal to or greater than the LD_{100}. An ascorbic acid dose of 750 mg/Kg given every 4 hours for 2 days then every 8 hours till death proved to be toxic if the pH remained at 2.9.

In Vitro Adherence of *Brucella abortus* to Host Cells. GORDON D. SCHRANK, CLAUS B. SCHULZE and BOB A. FREEMAN, The University of Tennessee Center for the Health Sciences.

Because brucellosis is a complex disease in which the causative organism is a facultative intracellular parasite, most studies of this disease have dealt with late events in the host-parasite relationship. The purpose of the present study is to examine the role of bacterial adherence and early events in establishing an infection with *Brucella abortus*. *Brucella abortus*, strain 2308, adheres to the following bovine or guinea pig tissue cells: small intestine, fallopian tube, uterus, esophagus, and trachea. Adherence to ovary or spleen cells could not be demonstrated. Pretreatment of isolated guinea pig intestinal cells with trypsin (2.5%), pepsin (10 U), pronase (10 U), papain (10 U), or sodium metaperiodate (10mM) does not decrease or prevent adherence. Addition of Triton X-100 (0.1%) or Tween 80 (0.1%) to the mixture of host cells and bacteria has no effect on adherence. Preincubation of host cells with the following carbohydrates (25 mg/ml) does not decrease or block adherence: D-galactose, D-rhamnose, L-fucose. i-erythritol, D-mannose, L-rhamnose or N-acetyl-D-glucosamine. A rough variant of strain 2308 shows the same adherence pattern as the smooth parent strain. Adherence of the smooth strain is neutralized by homologous whole cell antiserums. T Lymphocyte Mitogenic Properties of Group A Streptococcal Lipoteichoic Acid. W. A. Simpson, I. Ofek, E. H. Beachey, J. B. Dale, S. Grebe and A Ahmed, VA Hospital and University of Tennessee, Memphis and Naval Medical Research Institute, Bethesda, MD.

Streptococcal lipoteichoic acid (LTA) is known to bind avidly to membrane receptors in a variety of animal cells. We studied lymphocyte binding and mitogenicity of LTA using murine and human lymphocytes erposed to radiolabeled LTA (^{3}H-LTA) and unlabeled LTA, respectively. Binding of ^{3}H-LTA was lymphocyte concentration and temperature dependent and reached a maximum in 15 min at 37°C. Binding was reversible and specific and Scatchard analysis revealed a single population of 5.8×10^7 binding sites per adult lymphocyte and 5.6×10^7 per cord blood lymphocyte, with dissociation constants of 1.2×10^{-8} M and 1.82×10^{-8} M, respectively. Immunological and genetic studies showed that the mitogenic response to LTA was limited to T lymphocytes and was present at birth in mice and humans. Dose response curves of lymphocyte stimulation induced by LTA and the binding of LTA to intact lymphocytes were shown to be related. These results suggest that LTA binds to receptor sites on T lymphocyte membranes to trigger the mitogenic response.

MEDICAL SCIENCES—SECTION II

B. R. JENNINGS, *Chairman*

Typhoid Fever: Report of a Case. CHARLES W. HARLAN, M.D. and JAMES S. BELL, M.D., The University of Tennessee, and GRETEL C. HARLAN, M.D., Doctors Hospital, Memphis.

V. J. H., a 14 year old black female, was admitted to a longterm care facility in Tennessee. Thirty-six days later she developed a boil, which was treated with peroxide. Subsequent fever (103 F.) was treated with a two day course of Ampicillin, 250 mg. q.i.d.. She complained of head pains upon standing. On the thirty-eighth day, fever returned (103 F.). She was found dead on the morning of the fortieth hospital day. Autopsy revealed bilateral pneumonia, pulmonary edema, and meningoencephalitis. Pure cultures of *Salmonella typhosa*, V_i bacteriophage type A, were obtained from lung and cerebrospinal fluid. Blood cultures grew *Salmonella typhosa, Escherichia coli* and *Klebsiella species*. Histologic examination shows characteristic gram-negative bacillus pneumonia, meningoencephalitis, typhoid nodules (liver), and fatty liver. Pulmonary histoplasmosis was also present. Three typhoid carriers were identified at the long term facility and were treated.

Localization of Pancreatic Polypeptide Antigens. L. P. KING, R. L. SIEGLE, P. L. ADAMS and B. R. JENNINGS, University of Tennessee Center for Health Sciences.

A pancreatic polypeptide has been isolated and, to some degree, characterized from bovine pancreatic extract, (Chance, et al). In order to study the binding of antiserum to the peptide (B PP) in rat pancrease, whole anti-BPP serum was injected IV and the pancreas excised. Extracts of pancreas, spleen, and liver were made and run against anti-IgG serum on an ochterlong plate. Precipitin bands appeared only for pancreatic extract indicating exclusive binding of anti-BPP serum to rat pancreas.

An indirect immunoperoxidase staining procedure is being developed for the purpose of determining cellular aspects of binding. The protocol includes the staining of tissue sections from rat pancreas, human pancreatic adenoma, human islet cell tumor, and normal human pancreas.

Forensic Serology in a Beastiality Case. T. P. SUTTON, The University of Tennessee, K. A. MALONE, Memphis Humane Society.

In February of 1978 our laboratory received an unusual and interesting sexual offense case—the victim was a female German Shepard dog. Since the accused was in custody and charges were being pressed, our duty was to supply the courts with conclusive serological evidence if possible.

Laboratory examination included the areas of: presence or absence of semen, hair transfer, signs of force, and blood analysis. Within limits, all areas of analysis are the same as with a human victim except emphasis must be placed on species origin.

Proof of blood found on physical evidence submitted was of little value unless testimony could show the origin to be dog and definitely not human. Presentation will show in greater detail how cross-reactivity of anti-sera was handled and method of testing and source of anti-sera were chosen.

Laboratory Workload Recording in Microbiology JACQUELYN BARD, B. R. JENNINGS, and GLENNA J. CORLEY, The University of Tennessee for the Health Sciences.

This paper describes our experience with a new method of calculating College of American Pathologists workload units in Microbiology. The method was described recently by Kreig and Shearer in Medical Laboratory Observer. The system is tied calculating College of American Pathologists workload units in Microbiology. The method was described recently by Kreig with our microbiology specimen logging system, making daily counting fast and accurate. The system is also readily amenable to changes made necessary when new laboratory methods are instituted. A practical procedure for microbiology workload recording has long been needed; with time, this method may prove to be better than those used previously.

Sudden Unexpected Death in the Swimming Pool. CHARLES W. HARLAN, M.D. and JAMES S. BELL, M.D.,The University of Tennessee, MICHAEL K. STOSKOPF, D.V.M., Johns Hopkins University and GRETEL C. HARLAN, M.D., Doctors Hospital Memphis.

Martin Henry, alias Tursiops truncatus, an 11½ year old, 284 pound, 89 inches tall, gray-white male was found floating dead in his swimming pool. He had been ill for several days, had not been eating well, developed halitosis and was not up to his usual tricks, after having given his customary outstanding and entertaining performance one week earlier. Autopsy examination revealed bilateral pneumonia with extensive abscess formation. Cultures disclosed a mixed flora composed of the following organisms: *Enterococcus, Edwardsiella tarda, Clostridium perfringens, Proteus mirabilis,* beta *Streptococcus,* and anaerobic gram-positive rods. Also present were multiple subcutaneous abscesses, abrasive ulcerations of the upper respiratory tract orifice and multiple skin abrasions and scars.

Trauma R_xs Through the Ages. JOHN M. PAY and DENISE I. PAY. Hospital St. Raphael, New Haven and East Tennessee State University.

Treatment of trauma may well be oldest and longest on the continuum of medical care. Archaeic orthopaedics is well documented through extant remains. Many therapeutic modalities have been passed to us through archaeic and primitive art; Egyptian papyri contain treatis pertaining to trauma; the Assyrian Code of Hammurabi legislated surgical malpractice; Greeks elevated medicine to a science; the pragmatic Romans established trauma treatment as a specialty. The hiatus of the Dark Ages saw the dramatic decline of medical science, specifically of surgery, lowering its practice to barbers, executioners and quacks. The scientific torch of this age was carried by Arabs, Persians, Indians and Chinese, and slowly returned to the West at the onset of the pre-Renaissance. Army physicians contributed much practical knowledge and inventive procedures to trauma therapy. The contribution of basic science discoveries and application of effective anesthesia provided more scientific and human milieu. Twentieth century infusions, blood transfusions, sulfonamides, antibiotics and instrumentation further enhanced the physician's odds for successful trauma treatment.

In this presentation, specific procedures are described and pertinent manuscript illuminations shown.

"Rape Causes Stress In More Ways Than One." ELIZABETH ANN FOWLER, AMELIA C. ROUTON, T. PAULETTE SUTTON, and JOHN W. HARRISON, The University of Tennessee.

This report concerns a series of five rapes by the same man over a two-month period. Large numbers of abnormal spermatozoa and epithetial cells with inclusion bodies were seen in the vaginal contents of two victims. The last three known assaults occurred within a nine-day period with the last two being within a forty-eight hour time span. The last two victims were the ones in which abnormalties were seen.

Since physical evidence, confessions, and/or victim identification were present in all cases, there was no doubt the five assaults were committed by the same eighteen year old defendant. It is theorized that increasing stress and frequency had a direct cause and effect on the large number of abnormal spermatozoa seen in the last two victims.

Spermatozoa Staining Using the Immunoperoxidase Method. S. H. SMITH, D. S. ACUFF, B. R. JENNINGS, U. T. Center for the Health Sciences.

Using the indirect immunoperoxidase procedure, as set forth by Sternberger, *et al,* an attempt to develop a technique of visualizing human spermatozoa for medico-legal purposes was made. Human semen samples were centrifuged, slide-smeared, and ethanol fixed. Commercially prepared rabbit anti-human semen immunoglobin was employed as the primary antiserum. Anti-rabbit immunoglobulin G, produced in a goat (GARG), was then applied, followed by a horseradish peroxidase anti-peroxidase (PAP) bridge and 3,3'-diaminobenzidine tetrahydrochloride (DAB) stain.

The commercially prepared rabbit anti-human semen antibody appeared to have greater reactivity against the seminal fluid antigens, and to a lesser degree, the sperm cell antigens.

The serum of patients with Disseminated Lupus Erythematosus was used as the primary antiserum in the peroxidase, anti-nuclear antibody (PANA) test procedure. This method revealed staining directed more against the antigens of the sperm nuclear material than against the seminal fluid antigens.

When using the serum of a vasectomized human male with anti-sperm antibodies, the spermatozoa staining was the most intense of any previous PANA or indirect immunoperoxidase procedural tests.

PHYSICS-ASTRONOMY SECTION

FRANKLIN C. MASON, *Chairman*

Comparison of Degree-Days With Residential Energy Use. RICHARD J. RARIDON, Oak Ridge National Laboratory.

The amount of electricity used in an all-electric home has been compared, on a monthly and annual basis, with degree-day data. It was possible to show the effect on energy consumption upon adding additional space to be heated and also the effect of reducing thermostat settings. For a house with a heat pump the rate of energy consumed was 1.3×10^{-2} kwh/degree-day/ft² of floor space.

Computer Analysis of the Results of Adding Attic Insulation to Residential Structures. THOMAS L. MOODY, Middle Tennessee State University, JOE SLOAN and JAMES ROWLETTE, Middle Tennessee Electric Cooperative.

Electrical energy consumption for a number of all electric homes was compared before and after attic insulation was added. The comparison was made using a statistical computer analysis of the energy consumption as a function of the degree day for the period in which the energy was consumed. The results are preliminary since the analysis was performed on a limited number of structures. The results do indicate the general accuracy and limitation of the analytical technique used for evaluation and the relative energy savings that can be achieved by reinsulating the attics of existing homes.

The Use of Scattering Angle As an Initial-Final State Relationship in Solving Collision Problems. JAMES MARION COOK, Middle Tennessee State University.

A definition is developed for the time-delay and scattering angle for a classical scattering process. A differential relationship is developed between these two quantities in a straightforward fashion. This relationship is re-obtained from classical mechanics by solving the Hamilton-Jacobi equation.

Analytical Solutions to the One-Dimensional, Tight-Binding Electron or Exciton Problem. DONALD R. PAYNE, Austin Peay State University.

An analytical solution to a one-dimensional, tight-binding band model is presented. The solutions are obtained for a single band case with only nearest neighbor hopping included and subject to the natural (fixed-end) boundary condition. The eigen-equation for the Hamiltonian is then a second order finite difference equation which can be solved exactly using a finite transform technique.

The solutions investigated include the wavefunctions, the energy eigenvalues, the density of states, and the conditions for localization. All the results are expressed analytically in terms of general parameters which, when specified appropriately, can be applied to various physical systems for electrons and excitons.

The Classical Billard Problem. GRAYSON H. WALKER, The University of Tennessee at Chattanooga.

A system consisting of a single point particle moving freely throughout a bounded region and colliding elastically with the boundaries of that region is termed a "classical billiard," and the task of providing a long term description of the particle's motion is the classical billiard problem. Classical billiards exhibit many of the types of behavior encountered in smooth hamiltonian systems yet they are much easier to study numerically. Consequently, a number of billiard systems have been studied numerically. There are also some rigorous mathematical results available for certain types of boundaries. We have made numerical studies of two billard systems—one falling within the domain of the rigorous theory and one which does not. We shall present these results along with a detailed comparison of behavior of the two systems.

Can a Small Physics Department Afford a Microcomputer Applications and Interfacing Course? DR. ERIC LANE, University of Tennessee at Chattanooga.

The Physics Department at a small urban state university attempts to develop a microcomputer facility to serve science majors, graduate engineers, technical students, high school teachers and the general public. The conflicts with other departments and their resolution will be discussed. Sources of funds and information will be presented.

Numerical Simulation of Molecular Collisions with a Small, Molecular Cluster in a Supersaturated Vapor. MARY J. FRENCH, The University of Tennessee at Chattanooga.

A numerical simulation of a small cluster of molecules interacting with the molecules of a supersaturated vapor has been carried out for a model system of spherical molecules interacting via a Lennard-Jones potential. The mass accomodation coefficient—the efficiency with which the cluster captures an impinging vapor molecule—has been estimated from the simulation over a small temperature range for both two and three dimensional clusters. In addition, information about the thermalization of the cluster has been obtained.

A New Approach to Videotaped Labs. R. R. MARCHINI, Memphis State University.

The Department of Physics at Memphis State University is producing a set of videotaped laboratory instructions for its liberal arts physics course. The innovative aspect of these videotapes is that they do not merely instruct the students in the laboratory procedure but, more importantly, they try to motivate the students into wanting to do the experiment. The video medium is used to show the students how the concept to be studied is relevant to their everyday lives. This is accomplished by remote shooting at such diverse locations as an amusement park, a brewery, or a Mississippi river boat, and by incorporating newsreel film, slides and off-air recordings of popular television programs into the production.

Muon Spin Rotation Studies of Polycrystalline Aluminum and Copper. D. WAYNE COOKE, Memphis State University.

Polarized positive muons have recently received much attention as probes for studying a variety of solid state phenomena. Experiments involving positive muon spin rotation can yield valuable information on the diffusion of light particles in metals as well as information concerning the nature of defects in metals. The applicability of μSR (the acronym is used to indicate the close analogy with ESR and NMR) to solids is due to the fact that magnetic interactions of the muon (spin = ½) can be detected by observing the distribution of muon decay positrons which is anisotropic with respect to the muon spin direction. Application of an external magnetic field causes the muon spin and hence the asymmetric decay pattern to precess, giving rise to a modulation in time of the probability that a positron is emitted in a fixed spatial direction. Recent experiments conducted at the Stopped Muon Channel of the Clinton P. Anderson Meson Physics Facility (LAMPF) will be described, and results obtained from depolarization measurements in aluminum and copper will be presented.

Transient Photovoltaic Effects in Lead Sulfide Films. M. M. GARLAND, Memphis State University.

Lead Sulfide films, vacuum deposited onto glass substrates at room temperature, show a number of interesting photovoltaic properties. The photovoltages are studied as a function of the duration and intensity of illumination at room temperature. Transient photovoltages are analyzed in terms of generation and recombination of free electrons and trapped holes.

Using Digital Weather Forecast for Microcomputer-Assisted Energy Conservation. DAVID E. FIELDS, Oak Ridge National Laboratory, JAMES J. DUNION, Oak Ridge Associated Universities, PATRICK F. BROWN, Department of Energy, Oak Ridge.

We propose a novel and cost-effective microprocessor-controlled thermal energy collection, storage, and disbursal system accessing digital weather forecast information. The forecast data would be utilized to develop an optimum thermal energy collection strategy for a future interval of several days. Technical considerations of information and information channel requirements are discussed, and one of several possible system structures is outlined. This particular structure consists of a single family dwelling with digital weather receiver, microprocessor (for analysis and control), rock thermal storage unit, and heat pump. Both this "smart" system, and an analogous "dumb" system lacking the rock thermal storage and microprocessor have been simulated on and Intecolor 8051 microcomputer, and results of these simulations will be presented.

Computerized Tomographic Scanning: A new Medical Imaging Modality. P. L. ADAMS, University of Tennessee Center for Health Sciences.

The advent of Computerized Tomographic Scanning has provided an important new technique for medical diagnosis. In addition to CT's impact upon radiological science, new contributions to imaging theory, detector design, and specialized computing hardware have resulted from its development. A tutorial review of this technique will be presented.

The CT scan results in a 2-D image of internal structures lying in a single thin plane perpendicular to the long axis of the body. Data is collected along ray projections of a collimated x-ray beam. The computer processes this information to reconstruct the image. Images taken from a number of adjacent planes provide a detailed 3-D study of the patient.

Scanning geometries and image reconstruction techniques will be presented. Some discussion of the extraordinary requirements of the technique in terms of counting statistics and amount of projection data needed will be included. The state of the art in image quality and new ideas for computerized scanning will also be discussed.

SCIENCE-MATH TEACHERS SECTION

CARL STEDMAN, *Chairman*

Probability of Success in College Chemistry. DR. RICHARD K. FLETCHER, JR., and JERRY GRAY, Tennessee Technological University.

This report includes the crosstabulation of ACT Composite Scores with the first quarter grades in college chemistry. The results are based upon a study of 135 freshman chemistry students at Tennessee Technological University. These students were selected randomly from the 700 plus freshman students enrolled for the Fall Quarter, 1976.

The results indicate that the ACT Composite Score is the best single predictor of success in college chemistry. When the ACT Composite Scores were grouped in five different ranges it was determined from a crosstabulation of the scores with first quarter grades that students with ACT Composite Scores of less than 20 had a very poor chance of success in the course.

The Use of Amateur Radio in the Classroom. GLENN G. TUCKER, Austin Peay State University.

Active amateur radio operators are working with teachers in many classrooms to bring another dimension to information gathering and to revitalize interest in what could be boring subject matter. Have you heard the most RECENT weather reports from California? From Africa? Have you compared the price of gasoline in Brazil with that in Tennessee?

With today's extreme interest in the C.B. fad, have you discussed with your science classes how radio works? How

your students can learn more about radio communication as a self-motivating learning tool?

The purpose of this paper is to give information to teachers about how they can incorporate into their classes this growing medium of communication and at the same time spark interest in their classroom activities.

Research Participation Programs at Department of Energy Facilities. A. WOHLPART, Oak Ridge Associated Universities.

Oak Ridge Associated Universities, a not-for-profit corporation of 45 colleges and universities, administers for the Department of Energy research participation and lecture programs. The purpose of these activities is to provide channels of cooperation and communication between colleges and universities on one hand and Department of Energy laboratories and technology centers on the other.

Opportunities are available for faculty members, graduate and undergraduate students in the physical, life, and social sciences; mathematics; and engineering fields to participate in the on-going research and development at fourteen Department of Energy facilities for either short or long terms. A faculty rotator program at the Fossil Energy Headquarters provides the opportunity to participate in program planning and review. Under the auspices of the Travel Lecture program, personnel from Department of Energy facilities and universities visit campuses to present lectures and seminars and to participate in colloquia.

"Evaluating Science Fair Exhibits from a Metric Perspective." BERNARD W. BENSON, University of Tennessee at Chattanooga.

The assumption that all measurements in science be reported using SI metric standards was tested through an evaluation of the exhibits presented at a 1978 Regional Science Fair. The data collected did not support the above seated assumption. The data will be enumerated and analyzed. Specific recommendations for teaching SI metrics and for applying SI metrics to science fair projetcs will be proposed.

The Advantages Associated With the Development of a Science Room in the Elementary School. JACK RHOTON, Kingsport City School System.

The judicious teacher attempting to capitalize on the inherent interest of children by providing opportunities for "hands-on" science experiences is often times confronted with many constraints that can dampen the enthusiasm of the teacher. Science materials and equipment in many instances are scattered throughout the school building with little effort for the centralized control of science materials. In many cases, both software and hardware are stored in the school library whereby teachers may check materials in and out as needed. However, one of the weaknesses of this system is that many times when materials are returned, certain items that have been exhausted may go unnoticed, therefore, creating frustration for the next teacher that utilizes the materials. This is especially true for "kits" that typify some national science funded projects. Even with the best effort to eliminate this restraint, this is not an easy problem to deal with. Many problems associated with teaching science in the elementary school can be eliminated with the development of a science room. This is not to suggest that a science room will serve as a panacea for all problems. Neither should it suggest that the science room is a substitute for existing science learning centers in the classroom. The opposite is true—a science room can support and enhance existing learning centers. Several advantages associated with the elementary school science room will be considered based on past experiences in the Kingsport City School System.

Four Generations of Polydactyly Type II. T. E. HEMMERLY, Middle Tennessee State University.

The diagramming and analysis of family pedigree charts is a useful technique in the teaching of genetics. A family chart including members of four generations, some individuals whom possessed the condition designated as polydactyly type II, was presented as an example of an abnormal trait determined by a dominant gene with variable expressivity.

Development of a Group-Demonstration Test for Piagetian Tasks. C. H. STEDMAN, Austin Peay State University.

Piaget and others have attempted to identify the presence of mental structures in children by administering tasks designed to evaluate very specific behavior. However, lengthy and detailed interviews, as valuable as they are, become rather impractical for the classroom teacher. Some type of group assessment would be valuable providing it had reasonable instructional validity.

A group test was therefore designed and it was used to test the following hypotheses:

1. The scores made by third-grade children on Piagetian tasks during interviews will not differ significantly from their scores made on a group-demonstration test.
2. Scores made on individual task items will not differ significantly when interview scores are compared to group test scores.
3. There is no significant relationship among sex, group size, or sequence in administering the test and total scores made on the interview or group test.

ZOOLOGY SECTION I

BILL A. SIMCO, *Chairman*

A Study of Herpetomonas muscarum. MILTON W. RILEY, Lee College.

Herpetomonas muscarum is a protozoan parasite commonly found within the alimentary tract of the common housefly, *Musca domestica.* It has previously been reported that these flagellates could survive the pupal stage of various Diptera. This paper not only documents this phenomenon but presents some of the morphological changes that occur in the parasite as it withstands pupation. This (and associated) phenomenon along with others, is also examined as a possible continuity of host and parasite life cycle which might insure the survival of the trypanosomatid species.

Effects of Ultraviolent Light on Hymenolepis diminuta Ova and Cysticercoids. W. DONALD MCGAVOCK, KATHRYN E. HOWARD, East Tennessee State University.

From this study, it is apparent that ultraviolent radiation produces deteriorative effects on the ova and cysticercoids of *Hymenolepis diminuta.* In most instances, development was impaired, but the irradiation was not totally lethal to all.

Wave length 2537 Å and a distance of two inches between the exposed material and source of radiation were the selected constant factors in this experiment. Time exposures were the variables. Exposures following the fifteen-minute irradiation period produced the most damage to the ova with an accompanying decrease in cyst viability.

The infective rate of irradiated ova and cysts was observed and found to be significantly less when compared with the infective rate of controls.

A Thin Section and Freeze-Fracture Study on Membrane Characteristics of Spermatozoa From the Isopod, Armadillidium vulgare. JAMES F. REGER and MALINDA E. FITZGERALD, University of Tennessee.

Membrane characteristics of mature spermatozoa examined by tannic acid processing, thin sections and freeze-fracture reveal four, specilialized particulate zones. Three occur at the juncture of nucleus, acrosome and cross-banded tail. One occurs as a repeat, periodic array of particles situated the length of elongate, cross-banded tail typical of pericarides, The three groups of P face particles situated at the juncture of nucleus, acrosome and tail include: 1) clusters of 8-10 nm size particles, 2) a linear array of 8-10 nm size particles extending the length of the acrosome, and 3) 8-10 nm size particles arranged in an orthogonal pattern. The periodically arranged plasmalemmal P face particles situated the length of the tail are in precise register with the major 70-72 nm repeat order exhibited by filaments of the tails. Evidence will be presented to show that all four sets of particles were associated wtih inner membrane densities, and where such particles are ordered the inner membrane density is of the same order. This data will be discussed in terms of the possible significance of such association.

Arsenic-induced Inclusions in the Parenchymal Hepatocyte of a Freshwater Teleost. ELSIE M. B. SORENSEN, ROLAND E. HENRY, and RUBEN R. MITCHELL. The University of Texas.

The direct exposure of *Lepomis cyanellus* (green sunfish) to arsenic results in the appearance of nuclear hepatocyte inclusions which become more numerous as both exposure time and exposure concentration increase. Since small quantities of organically bound arsenicals are volatized by an electron beam, X-ray energy dispersive analysis techniques could not be used in these experiments to either qualitatively localize arsenic subcellularly or quantitatively assess the effect of increased exposure to arsenic. For these reasons, subcellular isolation methods were employed to determine whether or not the nucleus was accumulating more arsenic as exposure time increased, as previously indicated by morphological data. These data indicated that after three weeks of exposure, twice as many nuclei contained inclusions as after one week. In our experiments the level of arsenic in the nuclear fraction increased from 12 to 58% between the second and sixth day of exposure while arsenic in the soluble cytoplasmic fraction decreased from 46 to 17% during the same period. These experiments provide additional evidence that rapid intracellular transport mechanisms result in the localization of arsenic within the nuclear fraction and that arsenic is stored largely in the nucleus.

Evidence of Wing Disc Cell Death as a Factor in the Cell-2 Mutant Phenotype of Drosophila melanogaster. T. JILL WHITEHEAD and D. B. BENNER, East Tennessee State University.

The fourth chromosome mutant *Cell-2* is characterized by a convergence of the L3 and L4 wing veins in the area of the anterior crossvein and at the wing margin, the absence of scutellar brustles, and the reduction or absence of ocelli. Using 10^{-6}M acridine orange stain (Spriej, 1971, Neth. J. Zool. 21:221) it was determined that dead cells occur in the central region of the wing disc. Wing discs from wild type flies showed the expected death of basal cells but few in the central pouch region. Bryant's (1975. J. Exp. Zool. 193:49) wing disc fate map shows this region corresponds to the margin of the imago wing. These results suggest that cell death is a factor in the covergence of the longitudinal veins in the region of the wing margin.

Water Mites (Genus Arrenurus*) of North Carolina.* JAMES L. WILSON, The University of Tennessee Nashville.

A preliminary list of water mites of the Gensu *Arrenurus,* identified from eleven collections made in North Carolina, is presented and discussed. Species from three different subgenera were identified. A brief discussion of several new species, not yet published, will be presented.

First Identification and Phase and SEM Analysis of Echiniscus viridissimus (Phylum Tardigrada) Outside its Type Locality. DIANE R. NELSON, East Tennessee State University.

This is the first report of *Echiniscus (E.) viridissimus* Peterfi, 1956, outside the type locality, and it constitutes a new record for North America. The tardigrade, previously described only once from Romania in moss frequently exposed to sunlight, was collected from a moss growing on concrete-brick posts in Johnson City, Washington County, Tennessee. The habitat is an open dry area, exposed to sunlight, rain, and winds near a major road. These dark green tardigrades belong to the *"viridis* group," which also includes the species *perviridis, rufoviridis,* and *viridis.* Identification is based on observations of distinguishing morphological characters with both phase and scanning electron microscopy. Photographs of the cephalic appendages, claws, and unique cuticular sculpture are presented.

The Odonata of Bay's Mountain Park, Sullivan County, Tennessee. DAN M. JOHNSON and CLIFF CONEY, East Tennessee State University.

Bay's Mountain Park (Sullivan County, Tenn.) contains several small streams, a 0.25 ha pond, and an 18 ha shallow eutrophic lake. Both pond and lake have stable water levels and, therefore, well-developed littoral vegetation. The pond contains no fish: the lake has been stocked with large mouth bass, bluegill, catfish, and pumpkinseed. Frequent collecting trips to this area since April 1977 have resulted in our identifying more than 40 species of odonates. Two of these have not previously been reported from Tennessee: *Celithemis verna* Pritchard and *Lestes eurinus* Say. Adult flight seasons are described for all species. The apparent coexistence of so many species raises intriguing questions with respect to niche partitioning.

Characterization of Water Quality Utilizing Populations of Chironomidae (Diptera). J. P. SWIGERT, D. STONEBURNER, and E. L. MORGAN, Tennessee Technological University.

Data collected during a year long sampling regime initiated March 1977 at alternate monthly intervals from two small impoundments on the Carl Sandburg National Historic Site, North Carolina revealed that Chironomidae (Diptera) populations are the dominant taxa collected in benthic macroinvertebrate petite ponar grabs. One impoundment on the property receives domestic septic leachate and urban runoff while the other impoundment collects primarily agricultural runoff. Environmental requirements and pollution tolerances of the Chironomidae are discussed along with nutrient loading and general chemical characteristics of the aquatic environment.

This project was supported by the U.S.D.I National Park Service, Southeast Regional Office, Atlanta, Georgia.

Effects of Environmental Chloride on Hemolymph Chloride Concentrations in the Crayfish, Procambarus acutis. P. B. TORRANCE, J. R. TOMASSO, and K. B. DAVIS, Memphis State University.

Exposure of the juvenile crayfish, *Procambarus acutis,* to 85.3 meq/1 chloride resulted in an initial increase in hemolymph concentrations, but within 15 days levels returned to normal (203.9±8.3 meq/1). Exposure to hypertonic chloride concentrations of 256.0 and 432.1 meq/1 (deionized water, constant darkness, 10° C) increased hemolymph chloride concentrations to near isotonic levels (267.0±6.1 and 380.3±11.7 S.E. meq/1, respecitvely). Environmental calcium (200 ppm) had no effect on hymolymph chloride levels of crayfish exposed to 256.0 or 432.0 meq/1 chloride for 6 days. Crayfish were able to osmoregulate at environmental chloride concentrations lower than their normal hemolymph concentration (206 meq/1 and osmoconformed at environmental chloride concentrations greater than 206 meq/1. The carrier at the gills responsible for uptake of chloride ions from dilute environmental concentrations did not immediately cease to function after exposure to 85 meq/1 chloride resulting in an initial increase in hemolymph chloride concentrations which subsequently returned to normal. Unlike fish, environmental calcium did not affect chloride uptake in crayfish.

Oxygen Consumption Rates of Selected Species of Freshwater Sculpins. MARTHA L. HUGHES, Tusculum College, and R. D. IKENBERRY, East Tennessee State University.

A comparative study of oxygen consumption rates of two species of freshwater sculpins, *Cottus bairdi* and *C. carolinae* was performed at 10°, 15° and 20° C.

The sculpins were acclimated to experimental temperatures prior to testing. Oxygen consumption was measured by a modified open system respirometer with dissolved oxygen determinations accomplished by a micro-Winkler method.

The overall oxygen consumption of *C. bairdi* and *C. carolinae* were not significantly different. Distinct differences in oxygen consumption as a function of body weight at the three temperatures were observed. The Q_{10} values for both species approximated two. Opercular movements were significantly different between the two species at all temperatures. Physiological compensation in response to low oxygen tensions included both increased metabolic and ventilation rates. Death rates of the two species during acclimation indicate *C. bairdi* has a lower thermal critical limit than *C. carolinae.*

Chloride Inhibition of Nitrite Induced Methemoglobinemia in Channel Catfish (Ictalurus punctatus). J. R. TOMASSO, BILL A. SIMCO, and KENNETH B. DAVIS, Memphis State University.

Exposure of channel catfish fingerlings *(Ictalurus punctatus)* for 24 hours to 1.0, 2.5, and 5.0 ppm nitrite (pH = 7; hardness = 40 ppm; temperature = 22-25° C) produced methemoglobin levels of 20.7±1.9%, 59.8±1.9%, and 77.4±1.4% (S.E.), respectively. However, methemoglobin levels were not elevated when fish were simultaneously exposed to 1.0, 2.5, and 5.0 nitrite and 25, 50, and 100 ppm sodium chloride, respectively. Acclimation to sodium chloride for 24 hours prior to exposure to nitrite did not significantly affect inhibitory action of sodium chloride. Fish exposed to 5 ppm nitrite for 5 hours developed 42.5±3.8% methemoglobin. When transferred to water containing 5 ppm nitrite and 100 ppm sodium chloride, methemoglobin levels returned to normal within 24 hours. Environmental chloride probably inhibits methemoglobin formation by competing with nitrite for entrance into the gills of the fish. An ionic ration of 16 Cl^- to 1 NO_2^- is capable of complete suppression of nitrite induced methemoglobin formation. Bicarbonate ion present in the test water (2 meq/L) may also have contributed to the inhibitive action of chloride.

Sodium Hydroxide Neutralization of Acid Receiving Streams in the Cherokee National Forest. J. ARWAY, W. F. PORAK and E. L. MORGAN, Tennessee Technological University.

Road construction through a pyritic strata of rock known

as the Anakeesta Formation has caused the drainage of toxic materials into tributaries of Citico Creek and Tellico River in the Cherokee National Forest. Water quality parameters, initially measured April, 1978, influenced by the Anakeesta leachates entering these streams include: decreased pH and increased acidity, conductivity, and heavy metals, i.e., aluminum, maganese and iron. Sodium Hydroxide Neutralization measures and permanent sealing of the road embankments with soil has been undertaken to control the acid drainage problem.

Results from 4-day in-stream fish bioassays using caged hatchery rainbow trout *(Salmo gairdneri)* and water quality had occurred within 3 months after the sodium hydroxide treatments began. Fish population sampling has shown slow migration of fish back into the acid accommodated streams. Aquatic macro-invertebrate community parameters taken at 19 sites monthly were evaluated to assess the effectiveness of Anakeesta leachate control measures.

This project was supported by funds provided by the U.S.D.A., Forest Service, Southeast Region, U.S. Federal Highway Administration. Region 15 and Aquatic Ecology Fund, Environmental Biology Research Program, Tennessee Technological University.

Effects of Environmental pH and Calcium on Ammonia Toxicity in Channel Catfish (Ictalurus punctatus). J. R. TOMASSO, CHERYL A. GOUDIE and BILL A. SIMCO, Memphis State University.

The twenty-four hour median lethal concentrations of total ammonia nitrogen (NH_3-N) to channel catfish fingerlings *(Ictalurus punctatus)* at pH 7, 8, and 9 (otal hardness = 40 ppm; temperaure = 21-24° C) were 263.6±11.3 (S.E.), 38.8±1.8 and 4.5±0.2 ppm, respectively. The un-ionized ammonia nitrogen concentration at pH 8 was significantly higher (1.82±0.06 ppm) than at pH 7 or 9 (1.39±0.6 and 1.49±0.12 ppm). Enrichment of the water to 200 ppm calcium at pH 7 significantly increased the 24 hr $L.C._{50}$ of total and un-ionized ammonia nitrogen (356.3±16.4 and 1.79±0.07). Fish exposed to 25 ppm NH_3-N for 12 hours at pH 7 and 8 showed no differences in hematocrit, percent total plasma protein, or plasma and muscle chloride as compared to control fish. Plasma sodium showed no difference between control and experimental groups at pH 7; however, a significant decrease occurred in fish exposed to 25 ppm NH_3-N at pH 8. No differences in blood pH were found between the control groups and fish exposed to 100 and 200 ppm NH_3-N at pH 7, and 10 and 25 ppm NH_3-N at pH 8.

Acute Toxicity of Kerosine to Fathead Minnows (Pimephales promelas). J. R. ORR, E. L. MORGAN and L. MARTINO, Tennessee Technological University.

To estimate the acute toxicity of kerosine to fathead minnows *(Pimephales promelas)*, 24 hour static and 96 hour continuous flow bioassays were conducted in July 1978. A modified Mount-Brungs proportional dilutor and Freeman constant flow delivery device was constructed for use in the study. Kerosine, a major substance employed in industrial and transportation operations, was tested at 25°C (±1°C) in moderately hard water. Mortalities were recorded and plotted by log probit analysis. Bioassays results of kerosine reflect a 96 hour LC50 value of 8,980 ppm by volume. These findings reveal that under the conditions of this test, kerosine tends to be acutely lethal to one-half the fatheads tested at levels near 1% over a 4-day period. A concentration of about 5000 ppm (0.5%) was found necessary to cause 50% mortality during a 1-day static bioassay. Apparent discrepancy between static and constant flow bioassays appeared to be due to lack of aeration and mixing in the 24-hour test.

The Incidence of Ethyl Alcohol in Blood Bank Blood. DAVID T. STAFFORD and JAMES M. MASON, University of Tennessee Center for the Health Sciences.

For a number of years the Univ. of Tennessee Toxicology Laboratory has used out-dated blood bank blood for the preparation of analytical standards. One of the standards is ethyl alcohol, and our observations led us to believe that an estimated 10-20% of the blood we received did contain measurable amounts of ethyl alcohol. A project was therefore initiated to determine more precisely how many units of blood collected do contain some alcohol. The results of this study indicate that of more than 500 units of blood examined, 11.05% do contain measurable amounts of ethyl alcohol. The mean concentration was 0.04 grams of alcohol per 100 mls. of blood (Gms. %), with a standard deviation of ± 0.04 gms. %. The range of the concentrations was 0.01 to 0.14 gms. %, with greater than 15% of the positives containing greater than 0.10 gms. %, the concentration level above which a driver is presumed to be driving under the influence of alcohol. It is believed that this problem is significant enough to justify further work to examine variations in the alcohol concentration as a function of source of supply.

ZOOLOGY SECTION II

DAVID SNYDER, *Chairman*

Taxonomic Use of Hair for the Mammals of Tennessee. JANET K. BRAUN, DWIGHT W. MOORE, MICHAEL L. KENNEDY, Memphis State University.

A key to the mammals of Tennessee was prepared using selective characters of dorsal guard hairs. Hair from the dorsal pelage was obtained from museum specimens. Bright-field light microscopy was used to determine width of the hair and internal structure. Scanning electron microscopy was used to determine surface characteristics of the hair. These characters combined with banding patterns and the general shape of the hair were used in the analysis. It was possible to identify all specimens to genus and in most cases refer specimens to species.

Genic Variation in White-tailed Deer from Arkansas. PHYLLIS K. PRICE and MICHAEL L. KENNEDY, Memphis State University.

Liver and kidney samples of 33 white-tailed deer *(Odocoileus virginianus)* representing three populations in Arkansas were examined with horizontal starch gel electrophoresis. Of 17 loci examined, only PGM-1 and ES-2 exhibited polymorphism. Average individual heterozygosity, ranging from 2.3% to 4.7% with a mean of 3.1%, was much lower than that reported for white-tailed deer in other parts of its range. The three populations examined in this study were highly similar based on Roger's genetic similarity coefficient.

Intraspecific Variation in the Prairie Vole, Microtus Ochrogaster, was examined using univariate and multivariate statistiphis State University.

Intraspecific variation in the prairie vole, *Microtus ochrogaster,* was examiner using univariate and multivariate statistical techniques. The study was based on 12 morphologic characters from 15 quadrats located in Arkansas, Missouri, and Tennessee. In total, 271 specimens were used in the data analysis. A matrix of correlations among characters was computed and the first three principle components extracted, which accounted for 91.1% of the variation in the character set. Three dimensional projections of localities onto principle components revealed interlocality variability in morphologic characters. Largest specimens were those from the southern part of the range in east-central Arkansas. Smallest animals were from northeastern Arkansas and southern Missouri. Generally, prairie voles from localities east of the Mississippi River clustered differently from those west of the Mississippi. In addition, specimens from east-central and central Arkansas cluster differently than those from northeastern Arkansas, southern Missouri, and northwestern Tennessee.

Status of the Woodland Jumping Mouse, Napaeozapus insignis, *in Tennessee.* NANCY D. MONCRIEF and MICHAEL L. KENNEDY, Memphis State University.

The present status of the woodland jumping mouse, *Napaeozapus insignis,* was determined in Tennessee. The status is based on published records, examination of museum specimens, and 67 *N. insignis* taken in Monroe Co., Tennessee between October 1976 and May 1978. Woodland jumping mice have been found to occur in a wide variety of habitats and in varying abundance in the eastern part of Tennessee. Exact habitat perferences in this region are yet to be determined. In order to best preserve and manage this species, all existing suitable habitat needs to be defined.

A Comparison of Preputial Gland Extracts With Selected Tissue Extracts. CLEMENT WELSH and R. D. IKENBERRY, East Tennessee State University.

Preputial glands as well as selected tissues of male and female laboratory mice *(Mus musculus)* were extracted in equal volumes of chloroform.

The extracts were subjected to gas chromatographic analysis and the resulting patterns were compared.

The preputial glands of both sexes demonstrated quantifiable amounts of two (as yet unidentified) compounds. All other tissues showed no trace of the former compounds.

Pheromonal Gland Studies of Selected Rodents. JOHN FRANKLIN ELLIS, JR. and R. D. IKENBERRY, East Tennessee State University.

Preputial glands of *Mus musclus* and the mid-ventral glands of *Peromyscus maniculatus* were extracted with chloroform and subjected to gas chromatographic analysis.

Chromatographic patterns for paired laboratory male and female *Mus musculus* were compared in relation to the female state of estrus. Male and female chromatographic patterns of *Peromyscus maniculatus* mid-ventral gland extracts were also compared.

Peromonal compounds of paired male and female *Mus musculus* preputial glands vary as a function of estrus cycle phases. The mid-ventral gland pheromonal agents of *Peromyscus maniculatus* indicate possible sex discrimination function.

The Roles of Testosterone and Contact Stimulation on Pheromone Production in Laboratory Mice. R. D. IKENBERRY, CLEMENT WALSH and JOHN FRANKLIN ELLIS, JR., East Tennessee State University.

Forty-eight adult male laboratory mice were castrated, divided into 2 groups of twenty-four. The larger groups were subdivided into 6 group of four animals each which received replacement testosterone injections on a 100%, 80%, 60% 40%, and 20% daily requirement schedule with one group receiving no replacement. The replacement therapy proceeded through twenty-four days. Contact stimulation of half the castrates was accomplished by placing four females in each cage twenty-four hours prior to analysis. Preputial gland extraction in chloroform was followed by gas chromatographic analysis.

A functional relationship between contact stimulation and testosterone levels was demonstrated in the preputial gland formation of pheromonal substances.

Swarming of Bats at Two Southern Ozark Caves. JOHN J. CASSIDY, GARY G. O'HAGAN, JOHN S. SANDERS, and MICHAEL J. HARVEY, Memphis State University.

Mist netting was conducted periodically at two Arkansas Ozark caves from mid-August thru October 1978 to study late summer and early autumn bat swarming behavior. A total of 1012 bats, representing 6 species and 4 genera of the family Vespertilionidae, was captured, examined, and released. Species captured and numbers were: *Myotis grisencens* (8); *M. keenii* (125); *M. sodalis* (63); *Pipistrellus subflavus* (750); *Eptesicus fuscus* (48); *Lasiurus borealis* (18).

Densities of the Raccoon, Proycon lotor, *in Western Tennessee.* DWIGHT W. MOORE and MICHAEL L. KENNEDY, Memphis State University.

Densities of the raccoon, *Proycon lotor,* were studied on five trapping grids located on Meeman Biological Field Station and Shelby Wildlife Management Area in Shelby Co., Tennessee. From 15 August 1977 to 29 August 1978, a total of 61 raccoons were captured. Fifty-eight animals were tagged and released on a combined study area of approximately 130 ha. Densities were estimated to be 1 raccoon/1.7 ha. using mark-recapture indices. Trapping success varied seasonally with temperature being the only weather variable which correlated with trap related activity.

Densities of the Opossum, Didelphis virginiana, in *Western Tennessee.* J. STEPHEN SANDERS, DWIGHT W. MOORE, and MICHAEL L. KENNEDY, Memphis State University.

Densities of the opossum, *Didelphis virginiana,* were studied on two trapping grids (combined area = approximately 80 ha.) located on the Meeman Biological Field Station, in Shelby County, Tennessee. From 15 August 1977 to 29 August 1978 a total of 26 opossums were captured of which 25 were tagged and released. Densities were estimated to be 1 opossum/1.7 ha. using mark-recapture indices. The number of captures on the study area with environmental temperature.

Food Habits of the Turkey (Meleagris gallopavo) *in West Tennessee.* F. RAFII-TABATABAI, R. S. RAFII-TABATABAI, and K. E. FONES, Memphis State University.

Feeding habits of the turkey *(Meleagris gallopavo)* were studied on Shelby Forest Wildlife Management Area during the spring of 1978. Gizzards of 37 birds were collected from hunters and examined for food content. Hackberry seeds *(Celtis laevigata)* made up approximately 64% of the material examined, and they occurred in 86% of the specimens. Green forbs *(Setaria sp.,* and *Oxalis sp.)* made up approximately 18% of the material examined, and they occurred in 75% of the specimens.

Distribution, Relative Abundance, and Habitat Preference of the Mississippi Kite (Ictinia misisippiensis) *in Tennessee.* FRED J. ALSOP, III, and PETER I. KALLA, East Tennessee State University.

The distribution, relative abundance, and habitat preference of the Mississippi Kite in Tennessee was investigated during two months of field work in the summer of 1978. Kites were found in Shelby, Lauderdale, Dyer, and Lake counties, and in the Reelfoot lake area. The birds appear to be concentrated in several areas near the Mississippi River: southwest of Memphis, Shelby State Forest, Anderson-Tully Wildlife Management Area. Moss Island Waterfowl Management Area, southern Lake County, and Reelfoot Lake. Thirty individuals were seen in the air at one time in Shelby Forest. The Mississippi Kite appears to prefer large, undisturbed, mature floodplain woodland for breeding. This type of habitat is rapidly becoming restricted to a few protected areas because of the encroachment of soybean farming. Also, logging may adversely affect habitat suitability.

The Relationship Between Cardiac and Ventilatory Activity in Serpentid Reptiles. JAMES S. JACOB, Memphis State University.

Records of simultaneous electrocardiographic and ventilatory activity from six species of terrestrial snakes have revealed an increase in heart rate during the intermittent ventilatory periods. This occurred in approximately 90% of the samples with a 20-30% increase in ventilatory over apneic heart rate The coordination between the increase in heart rate and periods of ventilatory activity (the heart rate-ventilatory response) is apparently a basic vertebrate feature since it occurs in fish and mammals, as well as in reptiles. Breathing tachycardia probably functions to allow a rapid equilibration of oxygen and carbon dioxide tensions in blood and tissues when oxygen is most readily available.

Digestive Tract Study In Six Salamander Species. DENISE I. PAV, JOE L. ROBERTSON and JING-MAY CHEN, East Tennessee State University.

Six species from four genera of the Family Plethodontidae, found in eastern Tennessee, were used in this study. The six species were selected according to their habitat preferences ranging from fully aquatic to entirely terrestrial groups. Measurements of digestive tract lengths were correlated to snout-vent lengths using standard regression biometry and Huxley's formula for allometry ($y=bx^{\alpha}$). In all six species isogonic growth of the gut was observed.

Comparison of Brain Growth Relationships between Eurycea bislineata *and Selected Members of Genus* Desmognathus. D. I. PAV, P. I. KALLA and R. J. COWIE, East Tennessee State University.

Brain growth relationships between *Eurycea bislineata* and selected members of Genus *Desmognathus* were studied. Measurements of brain weight and brain length were compared to snout-vent length. Sexual dimorphism in *E. bislineata* was also investigated. Standard regression analyses showed brain growth in *E. bislineata* to relate more closely to terrestrial groups of Genus *Desmognathus* than to the more aquatic members. Although no significant differences were found between sexes where brain weights were compared, a significant difference at ($P>.025$) was observed for linear brain measurements.

Weight Loss Due to Deprivation and Weight Gained Subsequent to Deprivation in Two Subspecies of Largemouth Bass. MELVIN L. WARREN, JR., and J. LARRY WILSON, University of Tennessee, Knoxville.

During a 123-day laboratory study, two subspecies of largemouth bass (*Micropterus salmoides salmoides* and *M. s. floridanus)* were compared as to weight loss due to deprivation and weight gained subsequent to deprivation. Significant differences in rate of weight lost were determined between the subspecies; however, this difference was partially attributed to initial size differences between the subspecies. Although no differences were found in the total weight gained, both subspecies showed rapid gains in a relatively short period of time.

Summer Habitat Selection of Striped Bass, Morone Saxatilis, *in Cherokee Reservoir, Tennessee.* H. R. WADDLE, J. L. WILSON, and C. C. COUTANT, University of Tennessee and Oak Ridge National Laboratory.

Summer habitat selection patterns of 18 adult striped bass *(Morone saxatilis)* in Cherokee Reservoir were monitored with externally attached temperature-sensing acoustic or radio transmitters from June through September, 1977. Summer home ranges of most fish correspond to cool, oxygenated spring or tributary effluents feeding shallow, submerged channels (less than 10 m deep) located in the lower reservoir. The inhabited areas or refuges differed from non-inhibited areas by maintaining temperatures less than or equal to 22 C and dissolved oxygen (d.o.) concentrations greater than 5 mg/1. Total water hardness, pH, and water transparency were not significantly different among refuges and non-inhabited areas.

Movement of fish outside refuges occurred more frequently and for longer periods during June when the temperature-d.o. regime was less severe. Fish experienced temperatures between 18.5 to 22.0 C. Several tagged fish migrated outside the refuges 15 and 27 C with mean temperatures of individuals ranging from and selected the lowest available temperature, generally near 21 C, even though d.o. concentrations at these temperatures were 3 mg/1 or less. Longterm survival of tagged and non-tagged fish outside refuges was undetermined because no fish were tracked outside a refuge for more than 12 days without being lost. This study indicates that temperature strongly influences the behavior of striped bass and that this species' thermal preferendum is approximately 21 C.

COLLEGIATE DIVISION

RICHARD J. RARIDON, *Chairman*

Comparative Study of Amphibian and Nonamphibian Vitellogenin. R. A. DEUFEL, Southwestern at Memphis University.

The similarity among vitellogenins from 8 different animals was tested by comparing rates of uptake in *Xenopus laevis* oocytes. Vitellogenin, a lipophosphoprotein, is synthesized in the animal's liver and transported to the bloodstream. Oocytes sequester vitellogenin and then use it as the main precursor in yolk deposition. Vitellogenin was labeled and isolated from 6 amphibians *(Hyla versicolor, Bufo marinus, Xenopus laevis, Rana pipiens, Ambystoma mexicanum,* and *Amphiuma mean tridactylum)* and 2 nonamphibians (Eastern box turtle and pigeon) using a pH gradient on a TEAE-cellulose column.

Oocytes segregated from *Xenopus laevis* were incubated overnight in the 8 different vitellogenins. Results showed that the oocytes sequestered all 8 kinds. Showing the highest uptake was box turtle vitellogenin with an uptake of 115.6 ng/mm²/hr compared to *X. laevis* vitellogenin uptake of 10.0 ng/mm²/hr, the control figure. The 2 salamanders' vitellogenin also showed high rates of uptake (3 - 9 times higher than *X. laevis).* The other three frogs' uptake level was in the range of the control figure.

Ancient Marginal Marine Oolite Shoal and Tidal Flat Deposits in the Mississippian Bangor Limestone Near Ladds, Tennessee. WAYNE K. WILLIAMS and RICHARD E. BERGENBACK, The University of Tennessee at Chattanooga.

Studies of bed morphology, large- and small-scale sedimentary structures plus texture and composition in a railroad cut of the Mississippian Bangor Limestone adjacent to Lake Nickajack near Ladds, Tennessee, have enabled recognition and interpretation of four facies:

Facies	Interpretation
1. Cut- and fill-structures, filled with oobiosparite, biosparite, biomicrite, micrite and quartz sandstone.	Tidal channel fill.
2. Massive-bedded, oosparite	Oolite shoals.
3. Laminated, dolomitized, pellet-rich pelsparite, pelmicrite and micrite with birdseyes.	Tidal flats.
4. Shale, light-green and medium-gray	Tidal flats or high subtidal.

Structured Programming In FORTRAN. DAVID B. ELLIOTT and LEE E. NIPPER, Tennessee Technological University.

It was shown in a 1966 paper by C. Bohm and G. Jacopini that only three basic program control structures are necessary to express the logic of any flow-chartable program, namely (1) statement sequencing, (2) IF-THEN-ELSE conditional branching, and (3) DO-WHILE conditional iteration. When one programs in a language (such as PL/1 or ALGOL) which contains these constructs, the explicit use of GO TO statements can be avoided, thus giving a program whose logic is more easily followed by the reader.

The purpose of our work is to provide the user with these basic control structures by supplying a preprocessor which translates these structures into compilable standard FORTRAN. Our goal is to increase ease of programming and provide program readability, both of which will most likely produce a more correct and better organized program.

Ancient Marginal Marine Oolite Shoal and Sabkha (Tidal Flat) Deposits in the Mississippian Pennington Formation Along Interstate 24 Near Whiteside, Tennessee. LEE THOMAS, JEFFREY ROBERTS and RICHARD E. BERGENBACK, The University of Tennessee at Chattanooga.

Studies of bed geometry, large- and small-scale sedimentary structures plus texture and composition in a roadcut (over 400 meters long) of the Mississippian Pennington Formation along Interstate 24 (Eastbound lane) near Whiteside, Tennessee, have enabled recognition of five facies:

Facies	Interpretation
1. Laminated, only slightly dolomitized, pellet-rich limestone with birdseyes.	Supratidal or high intertidal.
2. Shale, red and green.	Supratidal or high intertidal.
3. Cut- and fill-structures filled with intrapelmicrudite, greenish gray limestone.	Tidal channel fill.
4. Massive-bedded, rippled, oolitic medium-gray limestone at base grading upward to pellet-rich limestone with birdseyes and algal mats at top.	High subtidal to high intertidal or supratidal.
5. Micritic light gray limestone with moderate dolomitization and birdseyes.	Intertidal - probably high intertidal or supratidal.

London International Youth Science Fortnight. JANICE A. MILLER, Vanderbilt University.

The London International Youth Science Fortnight (LIYSF) takes place in London during the first two weeks of August each year, and this year brought together over 400 young scientists from 37 different countries. After conducting a research project at Indiana University Medical School, I attended the 1977 LIYSF as a United States delegate and was then selected to represent the United States on the staff of the 1978 LIYSF. The Tennessee Academy of Science partially sponsored my trip in 1978.

The LIYSF program is planned to include news and criticism of scientific developments, and to allow opportunities for discussion among the participants. There are lectures by eminent scientists, visits to industrial and research establishments and to University departments, as well as museums, seminars, discussions and films. Political leaders come to address the group, as well. Mrs. Margaret Thatcher, Leader of the Opposition, delivered an address on "Science and the Politician." But no doubt, the speeches that evoke the most comment are those that the participants present. The students report on their scientific research and lead discussions on various topics of scientific concern. Thus, the LIYSF provides not only the opportunity to evaluate one's own faculties of comprehension, but also to assess one's ability to communicate ideas and aspirations to others.

Science is an international activity by its very nature, and it is as citizens of the world that we are involved and committed to facing the realities of this world. This is the main theme of the LIYSF. I feel that the opportunities provided by the program allow its participants to assess their views on their responsibilities as scientists, not only to science but to their fellow scientists and to mankind. I wish to thank the Tennessee Academy of Science for allowing me to take advantage of these opportunities, for:

> "It is clearly our duty as citizens to ensure that
> Science is used for the benefit of mankind, for what
> Use is Science if mankind does not survive."

Autoradiographic Technique for ^{35}S in Kidney and Liver Tissues of Rattus norvegicus. CLAY M. DAVIS, Tennessee Technological University.

The distribution of ^{35}S by *Rattus norvegicus* was evaluated by coating emulsion autoradiography. Sulfur-35 assimilation in kidney and liver tissues was determined at 10 and 20 days post-tagging with $Na_2{}^{35}SO_4$. No specific localization of activity was found in either tissue. Radioactive Sulfur appears not to concentrate in rat liver and kidney but rather remains transitory in these tissues. Kidney tissue was found to contain higher levels of radioactivity than liver tissue at both 10 and 20 days post tagging. This difference was attributed to metabolic excretion processes.

Non-Periodicity of the Higher Order Trigonometric Functions. WILLIAM A. CONDON and WILLIAM JONES, Tennessee Technological University.

The higher order trigonometric functions are defined by

$$T(m,n;x) = \sum_{k=0}^{\infty} \frac{(-1)^k x^{km+n}}{(km+n)!}\ ,\ 0 \leq n < m,\ m \text{ \& } n \text{ integers}$$

A general De Moivre's theorem is found for these functions and used to prove that they are periodic if, and only if, $m = 2$.

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ATLAS OF THE VASCULAR PLANTS OF TENNESSEE II. MAGNOLIIDAE: ARISTOLOCHIALES, MAGNOLIALES, NYMPHAEALES, PAPAVERALES, PIPERALES, RANUNCULALES [1]

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ABSTRACT

County distributions are given for 106 Tennessee vascular plants in the subclass Magnoliidae.

INTRODUCTION

Following Cronquists' (1968) classification of flowering plants (Magnoliophyta), county distributions are given for Tennessee vascular plants in the subclass Magnoliidae and include the orders Aristolochiales, Magnoliales, Nymphaeales, Papaverales, Piperales, and Ranunculales. These taxa belong to what is traditionally referred to as the Ranalian complex. For the sake of convenience, taxa are arranged alphabetically by family, genus, and species without regard to phylogenetic relationships.

Nomenclature is that of current regional manuals except for Keener's (1976a, 1976b, 1977) recent revisions in the Ranunculaceae, as follows:

Consolida ambigua (L.) P. W. Ball & Haywood [*Delphinium ajacis* L.]
Enemion biternatum Raf. [*Isopyrum biternatum* (Raf.) T.&G.]
Hepatica nobilis Miller var. *acuta* (Pursh) Steyermark [*Hepatica acutiloba* DC.]
Hepatica nobilis Miller var. *obtusa* (Pursh) Steyermark [*Hepatica americana* (DC.) Ker]
Thalictrum pubescens Pursh [*Thalictrum polygamum* Muhl.]

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[1] Contributions from the Botanical Laboratory, University of Tennessee, N.S. No. 000.