

PROCEEDINGS OF THE TENNESSEE ACADEMY OF SCIENCE FOR 1953

ISABEL H. TIPTON, *Secretary*
The University of Tennessee, Knoxville, Tennessee
MEETINGS OF THE EXECUTIVE COMMITTEE

JANUARY MEETING

The Executive Committee of the Tennessee Academy of Science met at 8:30 a.m. on January 24, 1953, in Room 312 of the Joint University Library, Nashville, Tennessee. The members present were: A. J. Sharp, J. W. White, Carl Seyfert, C. L. Baker, J. M. Shaver, and I. H. Tipton.

Elected to regular membership in the Academy were:

Clyde C. Flanagan, 995 North Watkins, Apt. 3, Memphis, Tennessee.
Robert L. James, Mountain Home, Tennessee
Miss Louise Williams, teacher in Lakeland Senior High School, Lakeland, Florida, was elected to Life Membership.

The Committee voted to recommend to the Academy that Dr. Henry H. Hill, President of George Peabody College for Teachers, be made an Honorary Member of the Academy because of his continued support of the Society.

The Treasurer's report was approved, the report to be published in the JOURNAL in April, 1953.

It was suggested that the President appoint a committee to study the future of the JOURNAL and its editorship, Dr. Shaver to be chairman of the committee.

It was voted to commend the Teacher's Certification Committee for its part in the revision of the certification standards.

It was voted that the Academy bear the expense of the meeting of the Junior Academy and the Collegiate Section of the Academy, this action to be retroactive through the 1952 meeting.

It was voted to confirm the appointment of Dr. Glenn Gentry to succeed himself as a member of the Advisory Committee Reelfoot Lake Biological Station.

It was suggested that the Secretary and Treasurer work out a permanent record system for the membership list.

The possibility of canvassing industry in the state for sustaining memberships was discussed. It was suggested that this might be done most effectively through the Chambers of Commerce of the various cities in the state.

It was suggested that the press be informed of the activities of the Academy and invited to attend the Annual Meeting like regular members.

The Committee voted to accept the invitation of the Oak Ridge Institute of Nuclear Studies to meet in Oak Ridge on November 27 and 28, 1953.

The possibility of a business meeting during lunch on the Friday of the Annual Meeting was discussed.

It was suggested that a "Fellows Committee" be appointed to recommend AAAS Fellows from the Academy.

The meeting adjourned at noon.

NOVEMBER MEETING

The Executive Committee of the Tennessee Academy of Science met at 8:00 p.m. on November 26, 1953, at the University of Tennessee Faculty Club. C. T. Bahner, C. L. Baker, M. S. McCay, A.

J. Sharp, J. M. Shaver, Isabel H. Tipton and J. W. White were present.

The meeting was called to order and the minutes of the January 24, 1953, meeting were read and approved.

Informal reports were made by the officers, no formal action being taken on these reports.

The *Fellows Committee* report, made by C. L. Baker, Chairman, suggested thirteen names for recommendation as Fellows of the AAAS: Gould Andrews, Moffat G. Boyce, Carl M. Hill, Thelma Howell, Harry Klepser, Fred H. Norris, A. S. Rudolph, C. S. Shoup, Arlo I. Smith, James T. Tanner, Samuel R. Tipton, John D. Trimmer, Emily B. Walker.

It was voted to accept this report and to submit this list to the General Meeting.

The *Journal Committee* report made by Jesse M. Shaver, Chairman, was incomplete since no final action had been taken in the search for a new editor.

It was voted to ask the General Meeting to affirm the delegation of power of the Executive Committee to make decisions concerning disposal of the JOURNAL.

It was suggested that the Editorial Board be very carefully selected so as to be of real assistance to the new editor.

The *Research Committee* reported recommendations for two grants:

Richard Stevenson, *East Tennessee State College*, \$75.00.

Frank Barclay, *East Tennessee State College*, \$75.00.

Old Business: In the light of the two minor amendments to the Constitution which were read at the last Business Meeting and which might be voted on at the 1953 Business Meeting, the entire Constitution was examined and found to need revision in a number of places. It was voted to recommend to the incoming president the appointment of a Committee on Review and Revision of the Constitution and that the amendments not be brought before the Business Meeting to be voted on this year.

New Business: It was voted (1) to recommend to the Academy that Jesse M. Shaver be made an Honorary Member of the Academy in recognition of his service of 25 years as Editor of the JOURNAL. It was voted also that a purse of not less than \$200 be given to Dr. Shaver, the money to be taken from the Treasury, but to be made up by contributions. (2) It was voted to accept the Tennessee Psychological Association as an Affiliated Society of the Tennessee Academy of Science since the Psychology Section is no longer in existence. (3) It was voted to send a letter of felicitation to the Instituto Interamericano De Historia Municipal E Institucional on the 150th Anniversary of the Independence of Haiti and the Fourth Centenary of the Foundation of Sao Paulo, Brazil.

There being no further business, the meeting was adjourned.

THE SIXTY-THIRD ACADEMY MEETING

The sixty-third Meeting of the Tennessee Academy of Science was held November 27 and 28, 1953, in Oak Ridge, Tennessee, with the Oak Ridge Institute of Nuclear Studies as host. The Meeting was held in the Oak Ridge High School building. Registration was held on Friday morning. The First General Session was held on Friday morning, starting at 9:30 a.m., with the Academy President presiding. A Special Session on Nuclear Topics was held at 10:00, with S. C. Lind, of the Oak Ridge National Laboratories, presiding.

Friday afternoon was devoted to the several sectional meetings with the following chairmen presiding: Botany Section, Royal E. Shanks; Chemistry Section, A. M. Holladay; Geology-Geography Section, W. D. Hardeman; Mathematics Section, G. H. Lundeberg; Physics-

Astronomy Section, J. H. Coulliette; Zoology Section, J. J. Friauf. The Annual Business Meeting of the Academy was held at 4:30 p.m.

The Academy Dinner was held Friday evening in the Starlight Room of the Oak Terrace. The program honored Dr. J. M. Shaver for his twenty-five years' service as Editor of the Tennessee Academy Journal.

A Second General Session met Saturday morning, November 28, with Myron S. McCay presiding. The Fourth Annual Meeting of the Collegiate Division, Kenneth Sewell of Bryan University presiding, and the Twelfth Annual Meeting of the Junior Academy, Robert E. Dewese presiding, also were held Saturday morning.

FIRST GENERAL SESSION

IDENTIFYING ORIGINALITY. N. W. Dougherty, *The University of Tennessee*, Knoxville, Tennessee.

HIGH TEMPERATURE MASS SPECTROMETRY. Russell Baldock, *Oak Ridge National Laboratory*, Oak Ridge, Tennessee. Recent applications of high temperature mass spectrometry have yielded results of fundamental significance in gaseous phenomena. Investigations of ions formed in the gas arising from liquid germanium reveal clusters containing up to seven atoms per cluster. Molecular species of tin, lead and arsenic are also reported. It is shown that the discrepancy in the heat of vaporization of carbon may be due in part to the large amount of C_2 and C_3 evaporated from a graphite surface.

A CONSERVATION EDUCATION WORKSHOP. Fred H. Norris, *The University of Tennessee*. A full-time workshop course in conservation education was given during the first term of the 1953 Summer Session of The University of Tennessee. Thirty-one students, mostly in-service elementary school teachers, were enrolled under a procedure permitting each a maximum of nine quarter hours of credit in the College of Education. Course content centered around four major topics, soil, water, vegetation, and animal wildlife, with emphasis evenly distributed between basic informational concepts and their applications. During the session the first two weeks were spent on campus in regular class and laboratory work, the second two weeks in full-time group camp at Big Ridge State Park, and the final week divided between an additional two day field trip and classroom work. On campus, instruction was provided by representatives of the College of Education and the College of Liberal Arts. While in camp, the instructional work was cooperatively conducted by representatives of the State Department of Conservation, the State Fish and Game Commission, and the U. S. Soil conservation Service, in addition to those mentioned previously. A unique and important feature was the fact that all students were on scholarships provided by various garden clubs throughout Tennessee.

AN ANALYTICAL STUDY OF RACING RECORDS. M. H. Lietzke, *Oak Ridge National Laboratory*. Several previous attempts have been made to obtain mathematical correlations between the average rates and distances involved in various types of athletic competition. Although many interesting conclusions may be drawn on the basis of these attempts, none of them succeeds in integrating all the various types of racing into one unified picture. In the present development it is shown that the plot of the log of the distance versus the log of the time gives a linear relationship for all types of racing. A mathematical consequence of this relationship is that a plot of the log of the average rate for a given distance against the log of the distance is also linear. From the slopes of these latter plots it is possible to make quantitative comparisons of the rates of fatigue for all the various types of racing. In addition it is possible to calculate which records are out of line and by how much they can be broken when compared with the best efforts to date. Moreover, from the shape of the rate curves (especially for running) the range of the effect of the start and of the "second wind" can be accurately defined for

trained athletes. It is also shown that the same logarithmic relationships hold for horse racing as for human racing, and that the pattern extends even to auto racing.

THE DISTRIBUTION OF INTERSTITIAL AND INTRACAVITARY INJECTIONS OF CERTAIN PREPARATIONS OF MEDICAL INTEREST. Granvil C. Kyker, *Oak Ridge Institute of Nuclear Studies*. Internal use of radio-chemicals for therapeutic purposes presumes adequate localization of the material so that the dose of ionizing radiation is delivered to a particular organ or tissue. With the exception of very few radiochemical substances, normal chemical mechanisms do not provide the desired localization. Much of the current investigation of potential radiochemical medicinals emphasizes introduction of materials that are not mobilized but remain where placed. The nature of the preparation is an important factor to the pattern of distribution. Recent studies in experimental animals include the use of both colloidal and ionic preparations containing radioactive chromic phosphate, yttrium, and lutecium. The importance of the route of administration and of the chemical dose are illustrated by the results.

REPORT OF THE ACADEMY CONFERENCE REPRESENTATIVE. Clinton L. Baker, *Southwestern College, Memphis, Tennessee*.

SPECIAL SESSION ON NUCLEAR TOPICS

ISOTOPE EFFECTS WITH LABELED FORMIC ACID. A. J. Weinberger, O. K. Neville, and G. A. Ropp, *Oak Ridge National Laboratory*. The decomposition of formic acid in a large amount of concentrated sulfuric acid was studied. The formic acid used contained formic-C¹² acid and formic-C¹³ acid in the ratio of their natural abundance and also tracer quantities of formic-C¹⁴ acid. Successive fractions of the carbon monoxide evolved were collected. The C¹³ and C¹² content of each fraction was determined mass spectrometrically. The C¹⁴ content was measured with an ionization chamber—vibrating reed electrometer combination. From the data the ratios of the specific reaction rate constants for the three isotopically different varieties of formic acid were calculated. The ratios differed somewhat from those predicted by theory. A brief description of the equipment and method is given.

THE PREPARATION OF MICRO QUANTITIES OF CARRIER FREE NaI¹³¹ AND CH₃I¹³¹. Ben M. Benjamin and Ralph Livingston, *Oak Ridge National Laboratory*. Methyl iodide-131 of high specific activity was needed for microwave studies of its absorption spectrum so that the nuclear moments of I¹³¹ could be evaluated. Essentially pure CH₃I¹³¹ without added carrier iodine, was needed in such quantity that all chemical operations had to be carried out by remote control. It was synthesized by reacting an excess of methyl *p*-toluenesulfonate dissolved in butyl phthalate with a dry deposit of sodium iodide. In typical experiments about 750 mc of I¹³¹ (6 g) were used, and all operations were carried out with high vacuum technics. The sodium iodide had to be relatively free of foreign salts, and it was necessary to develop a chemical purification process for the active material as obtained from the isotope production division. This purification consisted of plating the iodine on a silver anode, washing and then stripping the iodine into an excess of an H₂S solution. A micro quantity of NaOH was added and the solution dried to give an invisible deposit of essentially pure NaI.

STUDY OF HYDROLYTIC POLYMERIZATION OF ZIRCONIUM AND HAFNIUM BY ULTRACENTRIFUGATION. J. S. Johnson and K. A. Kraus, *Oak Ridge National Laboratory*. The existence of polymeric species for zirconium in acidic solutions has been reported repeatedly. However, different authors have postulated widely different degrees of polymerization. A study of zirconium and hafnium in chloride solutions by equilibrium ultracentrifugation has been carried out in an attempt to clarify the situation.

Results indicate that in one molar acid, zirconium at a concentration of *ca.* .05 *M* exists primarily as a single species with molecular weight corresponding to a trimer. At lower acidity a mixture of species occurs with higher degrees of aggregation lower than at one molar acid. The degree of aggregation of hafnium in these media is very similar to that of zirconium.

SYMPOSIUM ON NEUTRON DIFFRACTION

NEUTRON DIFFRACTION. H. A. Levy, *Oak Ridge National Laboratory*.

NEUTRON DIFFRACTION STUDY OF OXALIC ACID DIHYDRATE. B. S. Garrett and H. A. Levy, *Oak Ridge National Laboratory*. The crystal structure of oxalic acid dihydrate has been studied by neutron diffraction. Two hydrogen atoms per molecule are shown by their positions in the lattice to be associated with carboxyl groups and four to be associated with water molecules. The entire acid molecule, including the hydrogen atoms, is accurately planar. The water molecule has dimensions similar to those of the gaseous water molecule. The arrangement of hydrogen bonds is delineated and the significance of the molecular dimensions is discussed. The data also yield information concerning the thermal motion of the molecules; an asymmetric displacement is indicated which is consistent with a large amplitude vibration about the carbon-carbon bond.

NEUTRON DIFFRACTION STUDY OF IODIC ACID. B. S. Garrett and H. A. Levy, *Oak Ridge National Laboratory*. The iodic acid molecule, HIO_3 , has the form of an unsymmetrical pyramid. Neutron diffraction study has shown that the hydrogen atom is attached to the oxygen atom forming the longest of the three I - O links. It is nearly co-linear with the shortest inter-molecular oxygen-oxygen approach, forming a linear chain of molecules linked by hydrogen bonding. A discussion of the molecular structure was given.

A NEUTRON DIFFRACTION STUDY OF POTASSIUM DIHYDROGEN PHOSPHATE AND ARSENATE. S. W. Peterson and H. A. Levy, *Oak Ridge National Laboratory*, and S. H. Simonsen, *University of Texas*. Potassium dihydrogen phosphate and arsenate are of especial structural interest because of the second order transitions to ferro-electric phases which they undergo at low temperatures. The crystal structures of these materials are known with the exception of the locations of the hydrogen atoms which are probably the key to the transition. Neutron diffraction studies of KH_2PO_4 at room temperature and at a temperature just above the transition and of KH_2AsO_4 and KD_2AsO_4 at room temperature have recently been completed. Work is also underway on the ferroelectric phase of KH_2PO_4 .

The diffraction data have been analyzed by a combination of Fourier, least squares and trial and error methods. Hydrogen positions for the normal phase of these materials, compatible with all of the sets of data obtained, were found to be located in pairs along oxygen-oxygen bond lines with the hydrogen atoms statistically distributed amongst the available sites placing on the average one-half hydrogen atom in each site. This corresponds to the expected distribution if the potential energy for the hydrogen atom between the two oxygen atoms has a double minimum. This result was quite unambiguous in the case of KH_2AsO_4 and KD_2AsO_4 but in the case of KH_2PO_4 the above model could not be clearly distinguished from a model containing centered hydrogen atoms with large vibrational amplitudes along the hydrogen bond. Asymmetric temperature motion was found to be characteristic of both oxygen and hydrogen atoms in all of these materials at room temperature.

BOTANY SECTION

UNAKA MOUNTAIN—AN INVITATION TO ECOLOGISTS. Richard Stevenson, *East Tennessee State College*. Unaka Mountain, in Unicoi County, Tennessee, and Mitchell County, North Carolina, offers a number of problems of interest to ecologists. The mountain covers an area of some 20 square miles, ranging in elevation from 2200 feet to 5238 feet above sea level. In the earlier days of the 20th century the area presented typical vegetational features (mixed hardwoods on the lower slopes and red spruce at the upper levels), but during the drought of 1925, some 5000 acres were severely burned. Original cover of red spruce remained in a few coves, while about 1200 acres were reduced to bed rock. Some areas are now restocking naturally, other areas have been replanted with white pine and other native species, and at the higher elevations there are extensive grassy areas. Thus the mountain offers a wide variety of ecological situations.

VEGETATION STUDIES ON THE GRASSY BALDS OF THE GREAT SMOKY MOUNTAINS. Vernon C. Gilbert, *University of Tennessee*. There are approximately 150 species of plants on the grassy balds of the Great Smoky Mountains National Park. The dominant grass is mountain oat grass (*Danthonia compressa*). This grass is the most frequent and has the highest coverage of any one plant. Cinquefoil (*Potentilla canadensis*) and sheep sorrel (*Rumex acetosella*) are very abundant. *Danthonia*, *Potentilla*, and *Rumex* in combination have a frequency of more than 80% for all the plots which were sampled. Sedges (*Carex* spp.) are commonly present with the grasses on the bald, *Carex debilis* and *Carex normalis* being most common. *Juncus tenuis* is typical along the trail edge. Shrubs and trees are typically present, although scattered. The blueberries, (*Vaccinium* spp.) are the most common shrubs, the high bush blueberry (*Vaccinium constablaei*) being typical of bald areas. The predominant deciduous tree is service (*Amelanchier laevis*) while pin cherry, mountain ash and *Crataegus* are very common.

PROGRESS ON THE STATE FLORA PROJECT. A. J. Sharp, *University of Tennessee*.

WOODY PLANTS OF TENNESSEE: SECOND SUPPLEMENT. Royal E. Shanks, *University of Tennessee*. During the year a number of additions or corrections to the checklist of woody plants have been made. Critical review of *Crataegus* by E. J. Palmer has added 13 and removed 5 taxa from the list *Viburnum recognitum* var. *alabamense* McAtee, newly described, is reported from Morgan County. *Rosa micrantha* Sm., escaped near Johnson City, was added to the list by R. L. James, who also contributed records of Carolina hemlock from Unicoi and Washington Counties. Several other cooperators contributed notable extensions of range mainly from the Cumberlands and the Tennessee Valley. It is proposed to keep distribution maps for the woody plants up to date, and to publish annual supplements.

GEOBOTANICAL PROSPECTING IN SOUTHEASTERN UTAH. Edward E. Clebsch, *University of Tennessee*. Two methods of geobotanical prospecting for uranium have been utilized in the southwestern United States. One is to find concentrations of plant species known to be uranium tolerant and/or selenium and sulphur-requiring. The other method involves interpretation of chemical analyses of mapped pinyon pine and juniper tree samples.

AN APPROACH TO THE SYSTEMATIC OF STIGEOCLONIUM. Herman Silva Forest, *College of William and Mary*.

STUDIES ON THE PHYSIOLOGY OF TOBACCO PLANTS INFECTED WITH BLACK SHANK. Frederick T. Wolf, *Vanderbilt University*, and Robert Schramm, *Duke University*.

CONSTRUCTION OF A PHOTOTUBE SOLAR RADIATION INTEGRATOR FOR FIELD USE. J. Gordon Ogden, III, *University of Tennessee*. The need for an instrument capable of providing integrated records of critical differences in light climate between and within forest types has long been felt among ecologists and microclimatologists. Instruments developed for this purpose have frequently proven unsatisfactory due either to expense, complexity and inconvenience, or indirectness of the method. The integrators which are described here are readily portable, relatively easy to construct, and were assembled at a cost of less than \$20.00 per unit. The units are housed in five-gallon paint containers with the lids pierced for mounting the phototubes. The covers, which are sealed from moisture are surmounted by an opal globe to provide a non-directional receptor, and the counters are mounted beneath small windows cut through the lids to facilitate reading of the instruments.

Four 45v. radio "B" batteries are used to provide the power source, and since the drain on the batteries is small, they can be expected to give satisfactory service approximately equivalent to their shelf life. The circuit consists of a phototube mounted in series with a small capacitor and a relay tube, which in turn is in series with a larger capacitor and a counting mechanism. The phototubes emit a current closely proportional to the intensity of the light falling on them, and the operation of the circuit is such that when the current passed by the phototube reaches a critical level, it is recorded by the counting mechanism.

CHEMISTRY SECTION

CHEMISTRY IN EVERY HIGH SCHOOL. Mrs. Robert Bell, *Greeneville High School*.

REACTIONS OF DIALKYL HYDROGEN PHOSPHITES WITH A, B-UNSATURATED SYSTEMS. Marvin A. McCall, Richard L. McConnell, and H. W. Coover, Jr., *Tennessee Eastman Company*, Kingsport. The reaction of dialkyl hydrogen phosphites with *a*, *B*-unsaturated compounds, using a sodium dialkyl phosphite catalyst, produces 2-substituted alkanephosphonates, $[\text{RO}]_2\text{P}[\text{O}]\text{CH}_2\text{CH}_2\text{Y}$, where $\text{Y}=\text{CN}$, COOR , CONR_2 , or COR . The products are colorless, mobile, distillable liquids. We have prepared several new phosphonates. The structures are proved by the Arguzov reaction as well as by hydrolysis of the phosphonates to known phosphonic acids. We have shown that unsaturated esters, amides, nitriles, and ketones react successfully. Pudovik and Arbuzov propose the 1, 2-addition of the phosphite to the ethylenic linkage as the mechanism for the reaction. We prefer a conjugate addition comparable to that of the amines since compounds of this type do not add to ethylenic bonds in the absence of peroxides. The presence of moisture stops the reaction, probably because of hydrolysis of the catalyst. This reaction presents a convenient method for producing phosphonates [C-P bonds] in 60-80% yields.

INTERFERENCE OF SULFATES IN THE DETERMINATION OF PHOSPHORUS BY THE MOLYBDIPHOSPHATE-ALKALIMETRIC METHOD. J. H. Robertson and A. J. Chadwell, Jr., *University of Tennessee*. Data are presented which require a revision of the current belief that the molybdiphosphate-alkalimetric method of determining phosphorus gives high results in the presence of sulfates. It is shown that with increasing additions of Na_2SO_4 , $(\text{NH}_4)_2\text{SO}_4$, or H_2SO_4 , the amount of phosphorus found increases to a maximum which is higher than the theoretical, then falls off progressively to values below the theoretical.

THE SYNTHESIS OF B-DIDODECYLAMINONAPHTHALENE BY MOLECULAR REARRANGEMENT. Samuel P. Massie, *Fisk University*, and Henry Gilman, *Iowa State College*. It was observed in the preparation of some amino derivatives of dibenzofuran that reaction of a halide in which the halogen was *ortho* to the ether linkage with sodamide in liquid ammonia gave the *meta* amino derivative. Extension of this work showed the rearrangement occurred with other ether and sulfide linkages. The use of dialkyl lithium amides in place of sodamide gave *meta* tertiary amines. Similarly lithium diethyl-amide and potassium amide gave *B* dialkylaminonaphthalenes on reaction with *a*-halogenonaphthalenes. These results demonstrated that rearrangement with alkali amide types are not limited to aryl halides in which the halogens is *ortho* to an oxygen or sulfur linkage. Subsequent studies showed that halogens *ortho* to dialkylamino groups underwent rearrangement. In the reaction of dialkyl lithium amides with aryl halides to give *meta* tertiary amines, it was found that lithium dibutylamide underwent rearrangement in better yield than lithium diethylamide. A logical extension of this reaction was the reaction of lithium didodecylamide with *a*-bromonaphthalene. Rearrangement was found to occur in 42 percent yield. The authentic sample of *B*-didodecylaminonaphthalene was prepared from *B*-*N*-dodecyl-naphthalene and dodecylbromide and the two samples were compared by conversion to the hydrochlorides.

IMPROVED APPARATUS FOR LABORATORY EXPERIMENTS REQUIRING RAPID AGITATION OF LIQUIDS. L. F. Woo, E. L. Compere, D. M. Richardson and H. F. McDuffie, *Oak Ridge National Laboratory*. A commercially available pneumatic tool, used for sawing and filing, has been found easily adaptable for providing agitation in laboratory studies of liquid-solid-gas and liquid-solid systems. The versatility of the apparatus has been demonstrated by the hydrogenation of benzene with Raney nickel at elevated temperatures, and the reaction between hydrogen and oxygen at high pressures in the presence of aqueous suspensions of a heterogeneous catalyst.

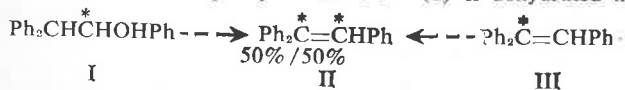
CHARACTERISTICS OF PM^{146} AND 140 . W. J. Martin and G. W. Parker, *Oak Ridge National Laboratory*. A long-lived promethium activity was first

identified with mass 145 by F. D. S. Butement after its formation by orbital electron capture in 400 day samarium-145 had been predicted. By means of an expanded production of samarium-145 it has been possible to confirm Butement's observations and to assign to Pm^{145} not only K and L X- radiation but two gamma rays of between 60 and 80 kilovolts. Since Butement worked with material irradiated at a very low flux, it was likely that his observations should include products of only a first order of neutron absorption. In contrast, in the initially separated promethium from the irradiated enriched samarium-144 an appreciable amount of gamma activity at energies of about 80, 460, 620 and 740 kev. were found. The obvious explanation, that due to the intensity and duration of the irradiation, the conversion of a portion of promethium to mass 146, was advanced. These observations have been confirmed by comparing these gamma energies with those found in neutron irradiated Pm^{146} and in the product of a p, n reaction on enriched Nd^{149} .

ORGANO PHOSPHORUS COMPOUNDS LABELED WITH P^{32} . W. H. Baldwin and C. E. Higgins, *Oak Ridge National Laboratory*. Radioactive phosphorus has potential applications as extensive as any other radioactive isotope. The strong Beta (1.7 mev.) emitted by this isotope makes possible the counting in solution with thin-walled glass G. M. tubes. Radioactive phosphorus is readily available as carrier-free phosphoric acid. Phosphoric acid has been employed as the silver salt reacting with butyl bromide to prepare radioactive tributyl phosphate. Dealkylation with sodium acetate at elevated temperatures forms the primary acid, dibutyl hydrogen phosphate in good yields. Ester exchange between natural tributyl phosphate and labeled hydrogen phosphate at elevated temperatures produces a mixture containing the two reactants as well as dibutyl hydrogen phosphate and butyl dihydrogen phosphate all of which are labeled with P^{32} . Longer times produce more of the labeled di- and tri-esters. Labeled phosphorus oxychloride results from the action of phosphorus pentachloride on anhydrous, labeled phosphoric acid. The Grignard reagent reacts with labeled $POCl_3$ giving compounds containing carbon to phosphorus bonds. Labeled di-2-ethylhexyl phosphinic acid and tri-n-octyl phosphine oxide have been useful in studying their solubility and their distribution between immiscible solvents. Hydrotropic solutions of the sodium salts of some acids of phosphorus are readily examined with labeled compounds. The equilibration of equal volumes of 0.05 M di-2-ethylhexyl phosphinic acid in dibutyl ether and 1 M aqueous sodium hydroxide gives a third phase occupying nearly 2.5% of the total volume. The third phase contains (by analysis) 32% water, 34% sodium di-2-ethylhexyl phosphinate, 30% dibutyl ether and 0.3% free sodium hydroxide. Di butyl hydrogen phosphate and dibutyl phosphinic acid solutions exhibit similar behavior with 5 M sodium hydroxide.

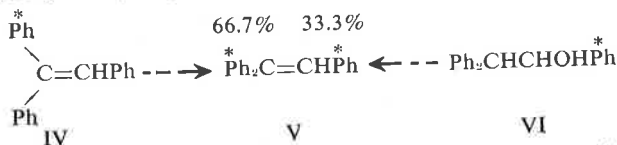
FREEZING POINT DEPRESSION OF FUSED SALTS. E. R. Van Artsdalen, *Oak Ridge National Laboratory*. The freezing point of a pure molten salt is depressed by the addition of a second salt and indeed according to the van't Hoff law for molal depression, well known in the case of aqueous and organic solutions. It can be shown that only those solute ions which are not common with solvent ions cause depression. Data obtained so far demonstrate that most simple salts behave as dissociated ideal electrolytes over a wide concentration range in the molten state. In favorable cases, solid solution solubility at very low concentrations can be deduced, while in other cases, measures of ion activities are obtained. Important information about the existence, stability and reactions of complex ions in fused salts can be obtained from freezing point measurements. Several examples are given to illustrate methods and results.

THE ISOTOPE POSITION ISOMERIZATION OF TRIPHENYLETHYLENE-1- C^{14} . Clair J. Collins, Samuel F. Clark and William A. Bonner, *Oak Ridge National Laboratory*. When 1, 2, 2-triphenylethanol-1- C^{14} (I) is dehydrated in boiling



xylene with an excess of phosphorous pentoxide, 1, 1, 2-triphenylethylene-1,

$2-C_{14}$ (II) results in which the radioactivity is equally divided between the ethylenic carbons. The same isotopic distribution results when 1, 1, 2-triphenylethylene- $1-C_{14}$ (III) is subjected to these conditions. Both 1, 1, 2-triphenylethylene-1-phenyl- C_{14} (IV) and 1, 2, 2-triphenylethanol-1-phenyl-



C_{14} (VI) when boiled in xylene with excess phosphorous pentoxide, produce olefin (V) in which the phenyl groups have become randomly distributed. Other acidic catalysts will also cause this isomerization, among these are *p*-tolenesulfonic acid. A kinetic study has been made of the action of the latter catalyst on the olefin III.

SOME CHEMICAL EFFECTS OF GAMMA RADIATION ON AQUEOUS SOLUTIONS OF ORGANIC ACIDS. A. Russell Jones, *Oak Ridge National Laboratory*. The exposure of dilute aqueous solutions of organic acids to gamma radiation from cobalt-60 results in the decomposition of the organic acid to a complex mixture of organic compounds. The non-steam volatile acidic product may be fractionated by partition chromatography and the individual acids may be characterized by the x-ray diffraction patterns of their silver salts.

A SIMPLE METHOD FOR MEASURING PRODUCT YIELDS IN THE DECOMPOSITION OF AQUEOUS SOLUTIONS BY GAMMA RADIATION. J. A. Ghormley and C. J. Hochanadel, *Oak Ridge National Laboratory*. Sealed ampoules made of glass or quartz and incorporating thin windows for spectrophotometric analysis of the solution, a capillary tube for determining total gas pressure in the ampoule by measuring the boiling temperature of the liquid, and a platinum filament for combusting hydrogen and oxygen gas mixtures, have been used to study the decomposition of several aqueous solutions by gamma radiation. Changes in pressure and in solute concentrations could be followed as a function of radiation dose using a single sample, and at any time during an experiment, the gases could be combusted giving a partial analysis. Yields for oxidation or reduction of the solute and for gas formation and/or depletion are reported for ferrous sulfate and ceric sulfate solutions.

THE POSITION OF THE INFRARED ABSORPTION OF THE CARBONYL BOND AS AN INDICATION OF CHEMICAL STRUCTURE. Essie M. Shelton and Nelson Fuson, *Fisk University*. The location of absorption bands in certain regions of the infrared spectrum has long been known to be characteristic of certain functional groups in the molecule. During the last few years more and more information has been obtained by the study of the precise location of these bands. This paper sketches the trend in this field of research, illustrating it by the effects of chain length and branching in alkyl alkyl ketones upon the position of the carbonyl bond vibration and by the relationship of the $C=O$ frequencies of substituted benzophenones and acetophenones to Hammett constants.

GEOLOGY-GEOGRAPHY SECTION

GEOLOGIC CROSS SECTIONS OF NORTHEASTERN TENNESSEE. Philip B. King, *U. S. Geological Survey*.

EXPLORATION FOR STRATEGIC MINERALS UNDER THE DMEA PROGRAM. Robert A. Laurence, *U. S. Geological Survey*.

THE KNOX DOLOMITE IN MIDDLE TENNESSEE. Roy Newcome, Jr., *U. S. Geological Survey*.

AREAL DISTRIBUTION OF SOME PENNSYLVANIAN SANDSTONES, NORTHERN CUMBERLAND PLATEAU, TENNESSEE. Charles W. Wilson, Jr., *Vanderbilt University*.

LOW ANGLE OVERTHRUSTING IN THE CENTRAL CUMBERLAND PLATEAU, TENNESSEE, AND ITS RELATIONS TO THE SOLE FAULT HYPOTHESIS OF THE

SOUTHERN APPALACHIAN VALLEY. Richard G. Stearns, *Tennessee Division of Geology.*

SANDY ZONES IN THE CHATTANOOGA SHALE OF EASTERN HIGHLAND RIM, TENNESSEE. Stuart W. Mahr, *University of Tennessee.*

MATHEMATICS SECTION

RELATIVE IMPORTANCE OF CERTAIN SUBJECTS AND TOPICS IN MATHEMATICS TO PRACTICING ENGINEERS AND TO PROFESSORS OF ENGINEERING. Walter W. Graham, *Vanderbilt University.* This study is an attempt to determine the extent to which certain topics in mathematics are needed by one who is beginning the study of engineering with the idea of practicing this profession. The measure of this extent is determined by a comparison of the uses of different subjects and topics in theory and in practice.

Acting on the assumption that the persons most capable of answering the points in question are those who practice and those who teach engineering, a questionnaire was sent to each of 300 members chosen at random from each of the societies, The American Institute of Electrical Engineers, The American Institute of Chemical Engineers, The American Society of Civil Engineers, The American Society of Mechanical Engineers, and The American Society of Engineering Education. This questionnaire listed the subjects algebra, trigonometry, analytical geometry, differential calculus, and integral calculus together with topics chosen from each. Usable replies were received from slightly more than 50% of the practicing engineers and from 68% of the Professors. The sampling was considered quite sufficient for a satisfactory statistical study. Answers showing different degrees of use were given different weights and these weights were adjusted to a common denominator for purposes of comparison. The mean weight, the standard deviation, and the coefficient of variation were computed for each of the five groups. The standard deviations in all cases were large indicating a wide spread in the distribution of the weights. The mean for the professors was noticeably higher than that for each group of practicing engineers and the corresponding coefficient of variation much lower. The coefficients of variation were very close in the case of the four groups of practicing engineers.

A summary of the findings is listed as follows:

1. The professors indicate a need for much more mathematics, as a whole, than do the practicing engineers.
2. A civil engineer, among the practicing engineers, is likely to use any topic of mathematics studied in this investigation more than an engineer from any of the other three groups; and a chemical engineer is likely to use any topic less than one from the other three groups.
3. The rank of importance assigned to subjects by the practicing engineers, as a whole, follows very nearly the order in which they are ordinarily taught. The civil engineers place trigonometry slightly above algebra. The professors place integral calculus in third place with analytic geometry in fifth place.
4. Certain topics are definitely of more importance to one group than to another.
5. Combinations of the five groups taken two at a time were studied. There is a very high degree of correlation between the ranks assigned to each of the topics by each group as computed in all ten combinations.
6. There is very little difference between the daily use of those topics of mathematics used most by the civil, electrical, and mechanical engineers. The difference between the chemical engineers and each of the other three groups is more pronounced.
7. In the majority of the cases the professors indicate significantly more use of mathematics than do the practicing engineers. In only three cases are the differences significantly in favor of the practicing engineers.
8. A separate course in mathematics, through the level studied here, taught for each of the four groups of undergraduate engineering students is probably not justifiable.

A MATHEMATICS CLUB IN A TEACHERS' COLLEGE. Sam K. Bright, *Austin Peay State College.*

NON-CREDIT COLLEGE MATHEMATICS COURSE. Harris J. Dark, *David Lipscomb College*.

ON A CERTAIN CONGRUENCE OF VARIABLE DEGREE. Herbert L. Lee, *University of Tennessee*. The congruence $X^{x-1} \equiv 1 \pmod{p}$ where p as a prime is considered. A sufficient condition is obtained for the solution of this congruence, viz. $p=na^n-n+1$ with $X=a^n$. By use of the primitive root g of p , it is found that a necessary and sufficient condition that the congruence have a solution is that for $g^k \equiv s \pmod{p}$, $p-1 / k(s-1)$.

PHYSICS-ASTRONOMY SECTION

EDUCATIONAL ASPECTS OF INFRARED SPECTROSCOPY. Wilbur Kaye, *Tennessee Eastman Company*. An extension of the use of infrared absorption theory and technique in undergraduate education is proposed. An inexpensive modification of existing visible and ultraviolet spectrometers for use in the near-infrared region is outlined, and examples of spectra obtained in this manner are given. This modification is achieved by modulating the light from the spectrometer, detecting the radiation with a lead sulfide cell, and amplifying the resulting signal with a simple audio amplifier.

RESEARCH IN INFRARED SPECTROSCOPY AT FISK UNIVERSITY. Nelson Fuson and Marie-Louise Josien, *Fisk University*. Fisk University is now placing considerable emphasis upon research in infrared spectroscopy and molecular structure. This emphasis has its origin in the pioneering work in infrared of Dr. Elmer S. Imes, Professor of Physics at Fisk University until his death in 1942. During the last five years a cooperative research program, staffed by members of the departments of chemistry and physics, has included problems in biochemistry, organic chemistry, physical chemistry, and chemical physics. Some of these problems were sketched in this paper. This program has included master's thesis investigations by graduate students in chemistry, physics and mathematics. Cooperation with other scientists and scientific laboratories, international as well as national and local, has been one of the congenial aspects of the Fisk Infrared Laboratory's program.

THE INFRARED SPECTRUM OF σ_2 FOR $B^{10}F_3$ AND $B^{11}F_3$. Alvin H. Nielsen¹, *University of Tennessee*. The infrared grating spectra of σ_2 for $B^{10}F_3$ and $B^{11}F_3$ have been re-examined from 650 - 750 K. Two samples of BF_3 , one composed of 93.4 percent $B^{10}F_3$ and 6.6 percent of $B^{11}F_3$; and the other of the normal abundance ratio 20 percent $B^{10}F_3$ and 80 percent $B^{11}F_3$ were secured for the investigation. Complete resolution of the rotational fine structure of this parallel-type band was achieved. The following constants were obtained by means of the usual sort of rotational analysis: For $B^{10}F_3$, $\sigma_0=718.23$ K, $B_0 = 0.3527_2$ K, $B(v_2 = 1) = 0.3528_8$ K, $D_J = 13.72 \times 10^{-7}$ K, For $B^{11}F_3$, $\sigma_0=691.45$ K and the rotational constants are the same for the two isotopic species.

THE INFRARED SPECTRA OF SEVERAL FLUORINATED CARBOXYLIC ACIDS. James R. Lawson, *Tennessee A & I State University*; Ernest A. Jones, *Vanderbilt University*; Nelson Fuson, and Marie-Louise Josien, *Fisk University*. The infrared spectra of perfluoropropionic and heptafluorobutyric acids have been obtained at room temperature in the liquid and vapor states and as solutions in carbon tetrachloride covering the spectral region two to fifteen microns. Through the aid of a previous study of CF_3COOH ,² band due to both monomeric and associated carboxylic acid molecules have been identified and vibrational assignments made. The influence of the strongly electronegative perfluoromethyl group on the COOH group vibrational frequencies has been noted.

¹Consultant at the K-25 Laboratories, Carbide and Carbon Chemicals Corporation, Oak Ridge, Tennessee.

This work was supported in part by the U. S. Army Office of Ordnance Research, and in part by the K-25 Laboratories Carbide and Carbon Chemicals Corporation, Oak Ridge, Tennessee.

²N. Fuson, M. L. Josien, E. A. Jones and J. R. Lawson, *J. Chem. Physics*, **20**, 1627 (1952)

ISOTOPE SHIFT IN THE ATOMIC SPECTRA OF BORON.³ E. W. Burke, Jr., *King College* This project was instituted to determine the magnitude of the isotope shift in the resonance transitions ($2s\ ^2S - 2p\ ^2P$) of the spectrum of doubly ionized boron, B III. The observed value could be compared with theory which had been worked out and applied to neutral lithium by Hughes and Eckart in 1930. The discrepancy between observed and calculated values for lithium and B III are comparable. Shifts were also measured in lines of singly ionized boron and neutral boron. Separated isotopes were used in this research.

RESULTS OF SPECTROGRAPHIC ANALYSIS OF TISSUES OF FORTY INDIVIDUALS. Isabel H. Tipton, *University of Tennessee and Health Physics Division, Oak Ridge National Laboratory*. A semiquantitative survey has been made of 20 trace elements in the tissues of 40 individuals. The results of this survey are given on slides showing the range of variation in concentration in the various tissues.

A PNEUMATIC MICROAMMETER.⁴ J. D. Trimmer and J. W. White, *University of Tennessee*. When a jet of air issuing from a nozzle falls on a flat plate, the force on the plate depends on the plate's distance from the nozzle. For nozzles of suitable flat shape, a position can be found at which the plate is attracted toward the nozzle with some force. If the air flowing through the nozzle flows first through a restriction and if this pressure is measured between the restriction and the nozzle, the pressure is found to be a sensitive function of plate position at the separation giving maximum attractive force. These findings can be applied to measurements of small electric currents by using the torque of a microammeter movement to change nozzle-plate separation.

COMPACT MERCURY SPECTRUM SOURCE FOR THE BASIC LABORATORY. M. S. McCay, *University of Chattanooga*, and E. S. Bishop (deceased), *Virginia Polytechnic Institute*. In a report to the American Physical Society, (SE Section) in 1948 the authors described a simple, inexpensive mercury vapor illuminant found useful as a source in the elementary laboratory. Improvements, including safeguards against harmful radiation from the germicidal lamps and convenient mounting on a self-contained grating system, were demonstrated with a working model.

CHARGING RATE OF MULTIPLE-TIP KELVIN WATER DROPPERS. M. S. McCay and W. Joe Warren, *University of Chattanooga*. In a study of atmospheric potentials with various charging devices, the influence of multiple-tip Kelvin water droppers on charging rate was determined. Curves indicating an "infinite" dropper system show that immediate charging response may be realized with a relatively small number of dropper-tips for low capacity systems.

THE RANGE OF BETA PARTICLES OF P³² IN DIFFERENT ATOMIC NUMBER ABSORBERS. T. E. Bortner, *Oak Ridge National Laboratory*. The range of beta particles in absorbers other than aluminum is somewhat vague. The purpose of this report is to show the range of P³² beta particles in six absorbers other than aluminum. These absorbers are listed in the table below along with the measured range in mg/cm². A standard thin mica window counter, with some modification in the shielding, was used. The source was collimated by means of a polyethylene collimator. To determine the range, P³² with aluminum absorber has been used as the standard and the Feather range analyzer used to determine the range in other absorbers. The range in different absorbers is given in the following table to ± 10 mg./cm.²:

Absorber	Range in Mg./cm. ²
Beryllium	863
Carbon	800
Aluminum	800
Copper	700
Tin	660

³Supported in part by the U. S. Office of Naval Research. Research done in the laboratory of Professor J. E. Mack, University of Wisconsin.

⁴This work has been supported by the ONR.

Tantalum	630
Lead	620

LOW TEMPERATURE SPECIFIC HEATS OF LAYERED LATTICES. A. S. Dworkin and D. J. Sasmor, *Oak Ridge National Laboratory*. Recently, equations have been derived which indicate a T^2 dependence of the low temperature specific heat for graphite based on a two dimensional frequency distribution function. Furthermore, it was shown that this dependence is an intrinsic property of the graphite layer like lattice. This predicted departure from the usual Debye T^3 law has been found experimentally for graphite, gallium, and boron nitride. Such anisotropic solids as selenium, tellurium and antimony also show anomalous behavior at the low temperatures and follow neither a T^2 nor a T^3 dependence. Boron nitride has a layer like structure very similar to that of graphite. We have measured the specific heat of boron nitride from 20°A to 300°A , and find that it obeys the T^2 law up to 66°A . Boron nitride is the first compound to show this dependence. It has been claimed that a number of other anisotropic layer type compounds have a low temperature T^2 specific heat dependence. Measurements have been made on these only down to 50°A , and conclusive evidence for a T^2 dependence is lacking. Cadmium iodide is an anisotropic compound which should also show anomalous low temperature specific heat behavior. We have measured its specific heat from 16°A to 300°A . At the low temperatures it is found to obey neither a T^2 or a T^3 law.

MASS SPECTROMETER ANALYSIS OF UO_2F_2 IN UF_4 . L. O. Gilpatrick, Russell Baldock, John Sites and H. E. Carr, *Oak Ridge National Laboratory*. A time integration method has been developed for the quantitative analysis of UO_2F_2 contamination in UF_4 . Data is collected from a sample held at constant temperature in the mass spectrometer until the sample is completely used up.

ZOOLOGY SECTION

OBSERVATIONS OF A FISH KILL DUE TO ACID POLLUTION ON EMORY RIVER, TENNESSEE. John W. Parsons, *Tennessee Game and Fish Commission*. The author observed a fish kill due to the toxicity of acid coal wastes on the lower five miles of Emory River near Oakdale, during the first week of December, 1952. Clear Fork, a tributary of Emory River, was subject to heavy rainfall during late November and large quantities of acid water were washed into Emory River. A pH of 5.3 was sufficiently low to kill most of the fish in lower Emory. This pH was maintained for at least four days. The fish succumbed to the toxicity of the acid water in the following order; gizzard shad, drum, game fish, catfish, buffalo, and carp. The smaller fish died before the larger ones. Some carp and buffalo appeared to survive the acid affects but not without noticeable coagulation of the mucous on the exterior surfaces of the fish. The formation of the acid and its subsequent effect on the streams occurred only after unusual but coincident phenomena.

ETIOLOGICAL STUDIES ON OYSTERS, II DERMOCYSTIDIUM MARINUM. H. Malcolm Owen, *University of the South*. In 1950, the fungus parasite *Dermocystidium marinum* Mackin, Owen, and Collier, was found to be associated with the mortality of oysters (*Crassastrea virginica* (Gmelin)) in the producing areas of southeastern Louisiana and Mississippi. This organism as it appears in the oyster is described, but all phases of its life cycle are not known. The histo-pathological details are illustrated by photomicrographs. The disease strongly resembles human blastomycosis. The organism is no respecter of tissues although the most usual site of infection is the intestinal epithelia. There is no marked toxic action, since extreme concentrations of parasites are built up before the host dies. Damage to the host was found to be caused by the lytic action of the parasite cells coupled with embolism in the later stages. Large numbers of phagocytes were observed at the sites of infections, and the parasite develops within them. The infection in the host progresses steadily; just as in human blastomycosis it increases with the age of the oysters. Studies on the culture of the fungus are reported.

EVENING GROSBREAKS IN THE GREAT SMOKY MOUNTAINS AND VICINITY, 1951-1952. Arthur H. Stupka, *National Park Service*. Observation of evening grosbeaks in Great Smoky Mountains National Park, near Gatlinburg,

Tennessee, on December 16, 1951, proved to be the southernmost record of these northern finches in the Appalachian Mountains. Up to 200 individuals were reported within a radius of ten miles from Gatlinburg during their winter sojourn in the area; the latest record came on May 4, 1952. Varying numbers of these birds were observed on 30 days during their four and one-half months visit.

INHERITED BRACHYCEPHALY IN AN INBRED STRAIN OF MICE (LINE 2159).
 Walter C. Morgan, Jr., *University of Tennessee*. Three phenotypically short-headed mice were first observed in a litter of seven, late in 1952. The parents were at F₁ in normal-tailed albino line 2159, which had previously been inbred for six generations. These three mice appeared remarkably alike in their abnormal state. Five months later, more brachycephalics were born. All mutants had a common progenitor, male #1435, which was the grandsire of the first mutants. The abnormal mice all had decisively shortened head; no doubtful intermediates being classified. All mutants were dead within twenty-four hours of birth; eleven of the seventeen were dead when the litter was first observed. The mutants, when alive, were observed to be gasping, thus suggesting an inadequate respiratory mechanism. All brachycephalics show a remarkable resemblance to an X-irradiated embryo illustrated by Russell (1950). Breeding results support the hypothesis that Brachycephaly behaves as a simple Mendelian recessive which is lethal when homozygous. From matings of known heterozygotes, a ratio of 17 abnormal : 49 normal has been obtained ($X^2 = .0202$, $P = .80 < .90$). In contrast to this, matings of known heterozygotes to mice of questionable genotype (but which were rejected from potential heterozygosity because no mutants were recovered) gave 156 normal : 0 mutants.

TEST OF CHEMICALS FOR MUTAGENIC ACTION IN DROSOPHILA MELANOGASTER.
 Neal Buffaloe, *David Lipscomb College* and *Vanderbilt University*. Four compounds tested, namely, benzene sulfonamide, chloramine T, dichloramine and sodium anthraquinone- β -sulfonate, proved to be non-mutagenic in *Drosophila* when administered by the feeding technique at concentrations which could be used in a practical manner. These compounds were chosen for testing on the basis of their chemical relation to known mutagens. Out of 2907 chromosomes tested for mutagenic action of these four compounds, seven developed recessive sex-linked lethal mutations, as compared to one lethal out of 702 control chromosomes. These lethal mutations were detected by the CIB method. The mutations detected for individual compounds are as follows:

Benzene sulfonamide	3/752 (0.4%)
Chloramine-T	2/767 (0.26%)
Dichloramine	1/739 (0.13%)
Sodium anthraquinone- β -sulfonate	1/694 (0.14%)

PROGRESS REPORT ON A STUDY OF THE TRICHOPTERA OF TENNESSEE. Sidney W. Edwards, *Vanderbilt University*. The work reported on is largely one of taxonomy. The problem was begun in the winter quarter of 1953 with collections of larvae and pupae in the Nashville area. With the permission of the Tennessee Game and Fish Commission, Division of Stream Survey, examinations were made of the bottom samples collected by that division during the previous year. These samples were obtained from 114 stations on 21 streams in Middle Tennessee and consisted almost exclusively of larvae. During the summer of 1953, collections were made in 28 counties at 131 stations in Middle and East Tennessee. Adult Trichoptera were collected by gasoline lantern and a portable mercury vapor neon tube. Laboratory rearing of the larvae has succeeded in several instances and more emphasis will be placed on this aspect in the future.

NEW EVIDENCE FOR THE VALIDITY OF DENDROTETTIX AUSTRALIS (MORSE).
 James J. Friauf, *Vanderbilt University*. In 1936, J. A. G. Rehn made *Dendrotettix australis* (Morse, 1906) a synonym of *Dendrotettix zimmermanni* (Saussure, 1861). The types of both of these species are unique females, and, until recently, the males of both were unknown. A third species in the genus, *Dendrotettix quercus* Packard is very distinct and does not enter into the problem of the validity of *D. australis*. Extensive collecting in Tennessee,

Alabama, and North Carolina has resulted in the accumulation of a series of both male and female *Dendrotettix*. With males now at hand, it becomes clear that Morse's species, *D. australis*, is valid and very distinct from *Dendrotettix zimmermanni* with regard to morphology as well as geographical distribution. The close resemblance of the females of these two species, along with the difficulty of their separation upon the basis of preserved specimens and comparison of but few individuals, makes Rehn's synonymy understandable.

THE EFFECTS OF PARATHYROID HORMONE EXTRACT ON THE REMOVAL OF RADIOACTIVE CALCIUM FROM THE BONE OF SHEEP. William E. Lotz, *University of Tennessee*. The effect of parathyroid extract administration upon the removal of radiocalcium and radiophosphorus from the long bones of sheep and its subsequent excretion in the urine was studied. Over a five day period of treatment radiophosphorus but not radiocalcium, was removed from the bone. The parathyroid extract produced only a slight rise in the urinary excretion which may be accounted for by the elevated serum phosphorus. Daily doses of 1000 i.u. of parathyroid extract over a seven day period resulted in an elevation of the serum phosphorus levels but not of serum calcium. It is concluded that in the sheep, parathyroid extract acts directly upon the bone particularly on phosphate and that any affect upon the kidney is minor in this dosage range.

ANNUAL BUSINESS MEETING OF THE ACADEMY₁₉₅₃

The Annual Business Meeting of The Tennessee Academy of Science was held in the cafeteria of the Oak Ridge High School Building at 4:30 p.m., Friday, November 27, 1953, with 46 members present. Immediately after the call to order by the president it was voted to change the order of business so that recommendations of the Executive Committee might be brought before the meeting.

The Executive Committee recommended:

(1) That Dr. Henry H. Hill, President of George Peabody College for Teachers be made an Honorary Member of the Academy in recognition of his support of the Academy.

(2) That Dr. Jesse M. Shaver be made an Honorary Member of the Academy in recognition of his service as Editor of the JOURNAL for 25 years.

(3) That Dr. Shaver be given a purse of at least \$200, this amount to be taken from the treasury of the Academy and made up by gifts. If the gifts exceed \$200, the difference to be given to Dr. Shaver.

All three recommendations passed.

The minutes of the previous meeting having been published in the Journal in April, 1953, they were not read.

Reports of Officers:

(1) *Treasurer*. The treasurer made mimeographed copies of an interim report available to all members. No action was needed on this report.

(2) *Secretary*. The Secretary made a plea for the names of officers of sections for 1954 and for abstracts of papers given at the 1953 meeting.

(3) *Editor of JOURNAL*. The Editor of the JOURNAL gave a brief oral report.

(4) *Director of Reelfoot Biological Station*. No formal report was given.

The Nominating Committee and the Resolutions Committee had been appointed by the president in advance of the meeting and their personnel was announced at this time:

Nominating Committee: Paris B. Stockdale, *Chairman*; Hanor Webb, C. L. Baker.

Resolutions Committee: J. J. Friauf, *Chairman*; Richard Stevenson; Samuel Bright.

A list of 56 names of recommended new members was posted on the bulletin board prior to the Business Meeting. It was voted to accept this list without it being read by the Secretary. The Secretary then announced a loss of 142 members during the year, leaving a total of 709 members.

Reports of Committees:

The JOURNAL Committee, J. M. Shaver, *Chairman*. In lieu of a formal report which could not be made at this time, Dr. Shaver, *Chairman*, made several suggestions and pleas:

- (1) That the Academy empower the Executive Committee to act in relation to the editorship and publication of the JOURNAL. This suggestion was put in the form of a motion by Dr. Hesler and was passed by the Academy.
- (2) That suggestions be made for editor from schools other than the University of Tennessee since it did not seem that the University would be able to give financial support to the JOURNAL.
- (3) That the present editor remain in office until a new editor and place of publication can be found.

These suggestions were approved by the Academy.

Science Talent Search Committee, James L. Major, *Chairman*

The following report was made by Dr. Webb in the absence of the chairman:

Year	Number Reporting	Attending College	Graduated	Graduate Study
1949	11	—	11	7
1950	9	8	1	1
1951	10	9	—	—
1952	14	13	—	—
1953	14	13	—	—

Year	In Service	On Scholarship	Working
1949	2	1	1 (Research Lab, Oak Ridge)
1950	1	3	—
1951	1	4	—
1952	—	8	1 (Hospital Technician)
1953	1	5	—

The report was accepted. It was suggested that a more complete report, showing how many took part in the Science Talent Search and how many were successful, be made next year.

Research Committee, J. H. Coulliette, *Chairman*.

The Research Committee recommended grants to Richard Stevenson, \$75.00; Frank H. Barclay, \$75.00.

Fellows Committee, C. L. Baker, *Chairman*.

The following list of names were submitted to be recommended to become Fellows of the AAAS: Gould Andrews, Moffat G. Boyce, Carl M. Hill, Thelma Howell, Harry Klepser, Fred H. Norris, A. S. Rudolph, C. S. Shoup, Arlo I. Smith, James T. Tanner, Samuel R. Tipton, John D. Trimmer, Emily B. Walker.

The list was accepted by the Academy.

The question of Fellows of the Tennessee Academy of Science was brought up. Mr. Baker said it was not in the power of his Committee to make recommendations for Fellows of the Academy, but he suggested that the incoming president appoint a committee to consider the question.

Report of the Fauna Committee, A. C. Cole, Chairman.

The following faunal research projects have been carried out during 1952-53 and are still in progress:

- (1) Taxonomic studies of Tennessee helminths, by A. W. Jones, H. L. Ward, and Honorico Ciordia, *University of Tennessee*, Knoxville.
- (2) Taxonomic studies of Copepoda, by H. C. Yeatman, *University of the South*, Sewanee.
- (3) Studies on cercariae of the Murfreesboro region, by J. A. Patten, *Middle Tennessee State College*, Murfreesboro.
- (4) Study of a new species of cestode from a shrew, by Danny Cox, *University of Tennessee*, Knoxville.
- (5) A comparative limnological study of Marrowbone Lake and Radnor Lake in Middle Tennessee, by Wymer Wiser, *Vanderbilt University*, Nashville.
- (6) Distribution and reproduction of the junco as affected by temperature in the Great Smoky Mountains, by J. T. Tanner, *University of Tennessee*, Knoxville.
- (7) A roadside census of birds of Knox County, Tennessee, by J. C. Howell, *University of Tennessee*, Knoxville.
- (8) Studies of amphibians, reptiles and fishes of Tennessee caves, by T. C. Barr, Jr., Nashville.
- (9) Studies of *Ambystoma* species and the water newt, *Triturus viridescens*, by Glenn Gentry, *Tennessee Game and Fish Commission*.
- (10) A study of the box terrapin, *Terrapene triangis*, by Glenn Gentry, *Tennessee Game and Fish Commission*.
- (11) A survey of reptiles and amphibians of middle Tennessee, by Ralph Sinclair, *Peabody College*, Nashville.
- (12) Studies of the water salamander, *Gyrinophilus warneri*, by Glenn Gentry, *Tennessee Game and Fish Commission*.
- (13) Distribution of two species of blind fishes of the family Amblyopsidae, by T. C. Barr, Jr., Nashville.
- (14) Fish populations in warmwater streams in middle Tennessee and on the Cumberland Plateau, by Eugene Ruhr, *Tennessee Game and Fish Commission*.
- (15) A study of the migration and seasonal aggregation of the gray bat, *Myotis grisicans*, by T. C. Barr, Jr., Nashville.
- (16) The Orthoptera of Tennessee, by J. J. Friauf, *Vanderbilt University*.
- (17) The Trichoptera of Tennessee, by Sidney Edwards, *Vanderbilt University*.
- (18) A taxonomic and ecological study of Collembola of East Tennessee, by T. P. Copeland, *University of Tennessee*.
- (19) The ant genus *Smithistruma* in East Tennessee, by W. J. Cloyd, *University of Tennessee*.
- (20) Scarabaeidae of the Chilhowee Mountains, by H. F. Howden, *University of Tennessee*.
- (21) Ants of the Chilhowee Mountains, by A. C. Cole, *University of Tennessee*.
- (22) The distribution of Zoraptera in Tennessee, by T. P. Copeland, *University of Tennessee*.
- (23) The Protura of Tennessee, by T. P. Copeland, *University of Tennessee*.
- (24) The Drosophila of Sullivan County, by T. M. Carter, *East Tennessee State College*.

The following research has been completed:

The triclad Turbellaria of the Nashville area, by J. R. Givens and J. J. Friauf, *Vanderbilt University*.

The darters of Tennessee, by W. S. Woolcott, *Carson-Newman College*.

The University of the South is establishing a biological station on the Woods Reservoir (located near Estill Springs) and is planning to do a considerable amount of research in limnology and ichthyology.

Report of the Flora Committee, A. J. Sharp, Chairman.

Collections in the State have been on a smaller scale than in the late forties

and more attention has been given to studies of certain taxa. Studies have been continued on the ferns by Dr. J. M. Shaver; the grasses and sedges by Prof. J. K. Underwood; the rushes by Dr. R. E. Shanks; the lilies by Prof. Eleanor McGilliard; the Scrophulariaceae by Dr. T. A. Frick. The Tennessee collections of *Crataegus* have been reviewed by Dr. E. J. Palmer and those of the Rubiaceae by Dr. Ray Fosberg.

The Resolutions Committee, J. J. Friauf, Chairman.

In recognition of the hospitality shown to the Tennessee Academy of Science, be it resolved that the Academy expresses its sincere appreciation to the Oak Ridge Institute of Nuclear Studies, and especially to Dr. Ralph Overman and his local committee which arranged the excellent facilities for the meetings and other activities.

Be it further resolved that this expression be spread on the minutes of this sixty-third meeting of the Tennessee Academy of Science, and that a copy be sent to the Oak Ridge Institute of Nuclear Studies.

Special Resolution, A. J. Sharp, Appointed by Dr. Carl Seyfert on November 29, 1952, as a committee of one for a resolution on the death of Dr. D. M. Brown.

DR. DALTON MILFORD BROWN
(1898-1952)

Inasmuch as Dr. Dalton M. Brown served well not only the institutions by which he was employed but science in general and the Tennessee Academy of Science in particular,

And inasmuch as he, as a regular member, as a contributor to the programs, and as a member of the Executive Committee and officers of this Academy, gave unselfishly of his time and energy to its affairs,

Be it resolved that the Tennessee Academy of Science acknowledge its serious loss in the untimely death of Dr. Brown and pay tribute to his memory by spreading this resolution on the minutes of the Academy and transmitting a copy thereof to his family.

Nominating Committee The Nominating Committee submitted the following slate of officers:

President—Myron S. McCay, University of Chattanooga

Vice-President—Frederick T. Wolf, Vanderbilt University

Treasurer—James W. White, University of Tennessee

Secretary—Isabel H. Tipton, University of Tennessee

The Secretary was instructed to cast the entire ballot for the slate as submitted by the Nominating Committee.

There being no further business the meeting was adjourned.

Officers for the Sections for 1954 are:

Mathematics Section:

Chairman: Prof. John T. Gray, University of Chattanooga

Secretary: Dr. Harris J. Dark, David Lipscomb College

Zoology Section:

Chairman: Richard Stevenson, East Tennessee State College

Botany Section:

Chairman: H. C. Phillips, Austin Peay State College

Vice-Chairman: Frank A. Barclay, East Tennessee State College

Secretary: Elsie Quarterman, Vanderbilt University

Geology-Geography:

Chairman: Robert Laurence, U. S. Geological Survey

Physics-Astronomy:

Chairman: Wilbur E. Kaye, Tennessee Eastman Corporation
 Secretary: E. W. Burke, King College, Bristol

Chemistry:

Chairman: Dr. S. C. Lind, Oak Ridge National Laboratories

THE ACADEMY DINNER

The Annual Dinner of the Tennessee Academy of Science was held in the Starlight Room of the Oak Terrace at 7:00 p.m., November 27, 1953. C. S. Shoup of the Atomic Energy Commission presided. The program was as follows:

Welcome. William G. Pollard, Director Oak Ridge Institute of Nuclear Studies.

Presentation of Officers for 1954.

Presentation of Honorary Membership to Dr. Henry H. Hill.

Honoring Dr. Jesse M. Shaver:

Henry H. Hill, President, George Peabody College for Teachers

John A. Behnke, Administrative Secretary, AAAS.

Nathan Woodruff, Assistant Manager for Operations, AEC.

A. J. Sharp, President, Tennessee Academy of Science.

SECOND GENERAL SESSION

HIGHLIGHTS OF EIGHT YEARS OF STABLE ISOTOPE SEPARATION. C. P. Keim, Director, Stable Isotope Research and Production Division, *Oak Ridge National Laboratory*. During the past eight years all naturally occurring isotopes of the elements below Bismuth in atomic number have been enriched in the Oak Ridge mass spectrographs or calutrons except the inert gases, Osmium, and the rare earth elements of atomic number above Gadolinium. The resultant isotopic purities and quantities (milligram or gram according to the natural abundance of the isotope) have been used in over two thousand research investigations in almost a hundred different laboratories. Each element has its own peculiar operating problems but the isotopes of all elements can be enriched to a high degree of purity in the calutron. The elements presenting interesting or difficult problems of processing are discussed. Some of these are: lithium, carbon, nitrogen, oxygen, chlorine, potassium, calcium, iron, selenium, zirconium, ruthenium, palladium, tin, hafnium, iridium, platinum, mercury, the rare earths, the inert gases. Some of the research done with certain isotopes are also presented. These include radionuclide production and decay studies, hyperfine spectroscopy, superconductivity, and neutron cross section measurements.

RECENT DEVELOPMENTS IN RARE EARTH CHEMISTRY. Boyd Weaver, Stable Isotopes Division, *Oak Ridge National Laboratories*. Within the last few years the development of new methods has made possible the production of large quantities of the individual rare earth elements in a pure form. Considerable quantities of several of the elements have been reduced to the metallic state for the first time and fundamental physical constants of the metals and compounds have been determined. Separations of the rare earths by the use of cation exchange resins have progressed from the milligram to the kilogram scale. New fractional precipitation techniques have been found useful in special applications. The most promising technique for the separation of rare earths is by countercurrent extraction between aqueous and organic solvents. The individual rare earths distribute in different ratios between strong nitric acid and tributyl phosphate. Thus in multistage countercurrent extractors a mixture may be divided into two fractions of very different composition, and the individual elements may be separated by successive extractions. By this means



Some of the guests at the speakers table, Annual Dinner, Tennessee Academy of Science. From left to right: Jesse M. Shaver, Mrs. Jesse M. Shaver, A. J. Sharp, Mrs. A. J. Sharp, Charles S. Shoup. Photograph by Joseph Houston, Oak Ridge Institute of Nuclear Studies, Inc., through whose courtesy this picture is being used.

kilogram quantities of neodymium, samarium, and gadolinium have been separated from complex mixtures and progress has been made in the purification of the rarer elements.

RADIATION AND DECOMPOSITION OF ICE. A. C. Stewart and S. A. Ghormley, *Oak Ridge National Laboratories*.

ANION EXCHANGE STUDIES OF METAL COMPLEXES. K. A. Kraus and F. Nelson, *Oak Ridge National Laboratories*. Anion exchange resins have been found to be very effective adsorbents for a number of metals from various media. Elution of the metals can often be effected by a simple change in medium or by use of water. In a systematic study of most metals in the periodic table, very large differences in adsorbability were found, even for elements which are often considered to be very similar. Since the adsorption of the metals is probably due to adsorption of their negatively charged complexes, the large differences in adsorbability probably result from large differences in the stability of these anionic complexes and from differences in their charge. The specificity of the exchangers for some negatively charged complexes is very high, permitting excellent adsorption under conditions where the fraction of the metal as negative complex in the aqueous phase is very small. Anion exchange of metal complexes appears to have considerable application for the separation of various elements, particularly from the analytical point of view. The strong adsorbability of certain elements under some conditions, their simple removal under other conditions coupled with the high specificity of the adsorption reactions makes large scale application of the technique attractive.

THE COLLEGIATE SECTION

A GENEALOGICAL STUDY. Anita Owens, *Carson-Newman College*.

PHOTOPERIODISM. Johnny M. Harris, *East Tenn. State College*.

THE USE OF MOIST MODELING CLAY IN THE PRODUCTION OF INEXPENSIVE CLASS ROOM MODELS. Alice White, *Bryan University*.

SOME OBSERVATIONS OF TURDUS MIGRATORIA IN TENNESSEE AND MICHIGAN. Betty Joy Rankin, *Bryan University*.

The judges awarded Anita Owens and Betty Joy Rankin a tie for first place in the paper competition. Alice White gained second place and Johnny M. Harris, third.

Three demonstrations were offered by A. K. Broyles, *East Tennessee State College*; Johnny M. Harris, *East Tennessee State College*; and Alice White, *Bryan University*.

New officers elected at this meeting are: President, John N. Fain, *Carson-Newman College*; Vice-president, A. K. Broyles, *East Tennessee State College*; Secretary-Treasurer, William Cumming, *George Peabody College*; Reporter, Jo Ann Wilson, *Carson-Newman College*.

JUNIOR ACADEMY PROGRAM

OPPORTUNITIES FOR THE YOUNG SCIENTIST. Aaron J. Sharp, President, *Tennessee Academy of Science*.

DESIGN, CONSTRUCTION, AND USE OF A STARK MODULATION MICROWAVE SPECTROGRAPH. Teddy Scott, *West End High School, Nashville*.

BACTERIOLOGICAL AND CHEMICAL ANALYSIS OF WATER. Robert E. Deweese, *Oak Ridge High School, Oak Ridge*.

REGENERATION IN SALAMANDERS. Susan Shelton, *Young High School, Knoxville*.

MY COLLECTION OF BUTTERFLIES AND MOTHS. Daisy Orr, *McMinn County High School, Athens*.

A MODEL TO SCALE OF THE PLANETS AND THEIR SATELLITES IN OUR SOLAR SYSTEM. Don Gentry, *West End High School, Nashville*.

VIVIPARY IN PLANTS. Mary Martha Sharp, *Bearden High School, Knoxville*.

TAXIDERMY. Henry Frankenburg, *Young High School, Knoxville*.

OPERATION BULBS—FULTON HIGH SCHOOL. James Bloomer, *Fulton High School*, Knoxville.

CHARACTER AND CULTURE OF TROPICAL AQUARIUM FISH. Barbara Wayman, *Young High School*, Knoxville.

INFLUENCE OF WATER PRESSURE ON THE HUMAN BODY. Jewell Mitchell, *Young High School*, Knoxville.

CHLOROPHYLL—ITS EFFECTIVENESS IN COMMON USAGE. Carol Miller, *West End High School*, Nashville.

EXCAVATION OF INDIAN MOUNDS AT WATTS BAR. John Krosnes, *Young High School*, Knoxville.

BIRD STUDY. Gail Belton, *Oak Ridge High School*, Oak Ridge.

TUMOR PRODUCTION IN THE GOLDEN HAMSTER. Chester Burns, *David Lipscomb High School*, Nashville.

SCIENTIFIC DEVELOPMENT, TRAINING AND SHOWING OF THE TENNESSEE WALKING HORSE. Betty Pendergrass, *Young High School*, Knoxville.

METEOROLOGY: RAIN TIME RECORDER. Benny Z. Meers, *Harriman High School*, Oakdale.

HIGH FREQUENCY HIGH VOLTAGE ALTERNATING CURRENT COIL. James Doyle Addison, *Meigs Consolidated High School*, Decatur.

PRINCIPLE OF THE PHOTO-ELECTRIC EFFECT. Chick Schwartz, *West End High School*, Nashville.

PROCESSING FILMS IN PHOTOGRAPHY. Larry Hendrix, *Young High School*, Knoxville.

ELECTRONICS. David Dawn, *Young High School*, Knoxville.

EXPERIMENT WITH GEIGER-MUELLER COUNTER. Stanley Von Hagen, *West End High School*, Nashville.

THE DRIPPING MERCURY CATHODE METHOD OF ANALYSIS. Jimmy Richens, *Christian Brothers College High School*, Memphis.

PELECYPODA SINCE THE PALAEOZOIC: A STUDY OF ADAPTATION TO ENVIRONMENT. Don Miller, *West End High School*, Nashville.

ATOMIC ENERGY. Marvin Blizzard, *Dobyns-Bennett High School*, Kingsport.

COSMETICS. Courtney Lewis, *Red Bank High School*, Chattanooga.

INDIAN RELICS. Earl Marler, *Red Bank High School*, Chattanooga.

METEOROLOGY. Billy Ticker, *Red Bank High School*, Chattanooga.

ALL WAVES ANTENNA. Woody Claxton, *Red Bank High School*, Chattanooga.

The judges awarded first place to Miss Daisy Orr of the McMinn County High School and Mr. Robert E. Deweese of the Oak Ridge High School, Oak Ridge.