

**PROCEEDINGS OF THE  
TENNESSEE ACADEMY OF SCIENCE  
FOR 1954**

ISABEL H. TIPTON, *Secretary*  
*The University of Tennessee, Knoxville, Tennessee*

MEETINGS OF THE EXECUTIVE COMMITTEE  
FEBRUARY MEETING

The Executive Committee of the Tennessee Academy of Science met at 9:30 A.M., February 27, in Room 303 of The Joint University Libraries in Nashville, Tennessee. C. L. Baker, M. S. McCay, Carl Seyfert, A. J. Sharp, J. M. Shaver, I. H. Tipton, Helen Ward, J. W. White, and Fred Wolf were present.

The meeting was called to order and the minutes of the November meeting were read and approved.

The Director of the Reelfoot Lake Biological Station reported informally that the appropriation from the state for the Station would continue and that the bridge would be fixed. The lack of graduate students for summer research was deplored.

It was voted to recommend for membership the applicants whose names are at present in the Secretary's hands.

The retiring Editor of the Journal made an informal report on sources of revenue for the Journal.

The Treasurer made available copies of his report for 1953, to appear in the April, 1954, issue of the Journal. The Committee voted to accept the report.

The President reported the results of the poll by mail of the Executive Committee in which (1) Dr. Helen Ward of the University of Tennessee Zoology Department was elected Editor of the Journal, and (2) the invitation to meet in 1954 at Peabody College was accepted.

It was voted to set the time for the meeting as November 26 and 27, 1954.

The Vice-President, Dr. Fred Wolf, discussed the preliminary plans for the Annual Meeting for 1954 and reported the appointment of Dr. Chadwick of Peabody College as Chairman of the Committee for local arrangements.

The President was instructed by a vote of the Executive Committee to appoint an Evaluation Committee to make a critical study of the meetings and to draw up a check list for procedures of future meetings.

A possible successor to Miss Bottum as Advisor of the Junior Academy was discussed, but since Miss Bottum's resignation had not been received no action was taken. A number of ways of stimulating interest in science in high school students was discussed.

It was the feeling of the Committee that the Evaluation Committee should study the method of making awards to Junior Academy members.

A Committee for Revision of the Constitution of the Academy was appointed, the members being I. H. Tipton, C. L. Baker, Carl Seyfert, and A. J. Sharp, Chairman.

The transfer of the Journal office and documents was discussed. It was voted to leave to Dr. Shaver's discretion what records of the Journal were to be saved.

The question of a historian for the Academy was brought up but no action was taken.

The Secretary was instructed by a vote of the Committee to set up a permanent card file of the membership, the choice of a system to be left to the discretion of the Secretary after study of possible systems.

The promotion of forming an Engineering Section was discussed.

It was suggested that the Membership Committee be regional in its make-up and that its duties be enlarged to include the rounding up of delinquent members as well as recruitment of new members.

The Treasurer was instructed to send out dues notices for the following year along with the programs before the annual meeting in the fall, a place for donations to a research fund to be provided on the dues blanks.

Three persons were selected for recommendation to the Academy for honorary membership, Dr. Hanor A. Webb, Dr. Frances Bottum, Dr. George Mayfield, a brief biography of each to be read when the names are presented to the Academy.

The question of Fellows of the Academy was discussed, but no action was taken.

The Secretary was instructed to obtain certificates to be given to honorary members and fellows.

There was some discussion of the time of awarding research grants. Applications for grants are to be made before December 1 in any year and the grants to be awarded at the winter meeting of the Executive Committee. This information is to be included in the letter which is sent out in August.

The meeting was adjourned at 1 o'clock.

#### NOVEMBER MEETING

The Executive Committee of the Tennessee Academy of Science met at 8 o'clock on the evening of November 25 in the Home Economics Building of George Peabody College for Teachers. Members of the Committee Baker, McCay, Seyfert, Sharp, Tipton, Ward, Wolf and White were present. Dr. Chadwick and Dr. Lagemann were also present. The meeting was called to order by the President and the minutes of the February meeting were read and approved.

The Editor of the Journal reported (1) that the printing of the Journal would be moved to Knoxville with the January issue; (2) that a suggestion had been made for the formation of a section in the Journal devoted to the High School Science Teacher, this section to be prepared in reprint form also and made available to those high school teachers who are not regular subscribers to the Journal; (3) the Editor asked that the price of single issues of the Journal be raised from 50c to 75c. It was so voted by the Committee.

The Treasurer made an interim report which showed a cash balance on hand of \$3570.29 as of November 20, 1954. It was voted that \$6.50 be taken from the Treasury to make the Shaver fund an even \$400.

The Secretary reported a total membership as of November 24 of 622 members. There were 134 members dropped during 1954—102 for dues, 32 at own request. The Committee recommended that the list of 46 new members be submitted to the Academy for approval, this list to be posted on the Bulletin Board and not to be read. Dr. Cartter Patten of Chattanooga was elected a Life Member of the Academy.

The Director of the Reelfoot Lake Biological Station read a report of the activities of the Station during 1954. This report will be published in the January, 1955, issue of the Journal.

The President reported the personnel of all the standing committees and the formation of a Planning Committee with Robert T. Lagemann of Vanderbilt University as Chairman and C. L. Baker, N. W. Dougherty, Kenneth Fry, Henry H. Hill, Wilbur Kaye, Sam L. Nicely, Jr., Cartter Patten, and A. J. Sharp as members. The President presented the booklet

on the History of the Academy with a request for suggestions for additions and alterations.

All the above reports were accepted.

The news of the resignation of Miss Frances Bottum as Advisor to the Junior Academy of Science was received with regret. A new Advisor for the Junior Academy will be elected by the Committee at the winter meeting.

The newly formed Planning Committee was represented by its chairman Dr. Lagemann. A report of the proposed activities and a request for suggestions for additional activities was made.

The Committee on Constitutional Revision submitted revisions of the Constitution which were discussed at some length. A copy of the proposed revised Constitution is to be sent to all members immediately after the November, 1954, Annual Meeting with request for suggested further changes to be made in writing before the winter meeting of the Executive Committee so that the revised Constitution may be voted on at the annual meeting for 1955.

The meeting was adjourned at 12:45 A.M., November 26.

#### THE SIXTY-FOURTH MEETING

The sixty-fourth meeting of the Tennessee Academy of Science was held November 26 and 27, 1954, in Nashville, Tennessee, with George Peabody College for Teachers as host. C. S. Chadwick was Chairman of Local Committee; F. T. Wolf was Program Chairman.

Registration was held in the Bruce R. Payne Building on the Peabody campus on Friday morning, November 26. The General Session was held on Friday morning in the Industrial Arts Building with the Academy President presiding. A symposium, "Some Problems of Physical Chemistry at Elevated Temperatures," was held at 9:00 A.M. in the Payne Building, with S. C. Lind, of the Oak Ridge National Laboratory, presiding. The Business meeting was held in the Industrial Arts Building at 11:00 A. M. Friday.

Friday afternoon, meetings of the several sections were held in the Payne Building with the following chairmen presiding: Botany Section, Haskell C. Phillips; Chemistry Section, S. C. Lind; Geology-Geography Section, Robert A. Laurence; Mathematics Section, John T. Gray; Physics-Astronomy Section, Wilbur Kaye; Zoology Section, Richard Stevenson.

The Academy Dinner was held Friday evening at the Methodist Board of Education Building. The Honorary Members were presented. Dr. Wilbur E. Kaye of Tennessee Eastman Company made the address.

The Fifth Annual Meeting of The Collegiate Division, John Fain, Carson-Newman College, presiding, and the Thirteenth Annual Meeting of The Junior Academy of Science, Joe E. Chapman, presiding, were held in the Payne Building Saturday morning, November 27.

#### GENERAL SESSION

THE PRESENT STATUS OF SPECTROSCOPY IN MOLECULAR STRUCTURE DETERMINATIONS. Ernest Jones, *Vanderbilt University*, Nashville, Tennessee.

ACADEMIC PREPARATION OF HIGH SCHOOL CHEMISTRY TEACHERS. Lone L. Sisk, *Milligan College*, Milligan College, Tennessee.

The purpose of this study is to determine why high school students dislike and refuse to study chemistry. This appalling fact is rapidly becoming a national catastrophe. Working from the assumed hypothesis that the teacher who knows chemistry will be one who can and will inspire a love of and a desire for chemistry, the problem was attacked from the basis of academic preparation of those who are teaching chemistry in the high schools of Tennessee.

From the state high school supervisor the names and certification numbers of all people teaching chemistry in the white high schools of the state were obtained. There were 154 bachelor degrees and 69 master degrees people teaching chemistry. The academic record of each teacher was checked in the Division of Certification files. Of the bachelor degree teachers only 20 percent had a major in chemistry. The remainder had majors in eighteen subject matter fields from agriculture through all the educations to zoology. The median preparation was 16 quarter hours of chemistry. Of the 69 master degree teachers there were only 31 with complete undergraduate and graduate records on file. Only seven of them had any graduate chemistry credit. Of the 31, three had chemistry majors; there were three biology majors, 3 mathematics majors, two home economics majors, and twenty majors in the various educations. By legal processes these people are declared qualified chemistry teachers.

It appears from this study that the majority of chemistry teachers in Tennessee high schools are teachers who "took" chemistry merely to meet graduation requirements, or to meet requirements in other major subject matter fields, that they are teaching chemistry by assignment, not by choice, that they are not interested in chemistry as such, that they give, and rightly so, their creative zest in their major fields of interest. The result is poor chemistry teaching. If poor preparation is not the principal reason for the dislike and decline of chemistry in high schools, it must be one of the factors close to the top of the list.

GRADUATE TRAINING IN THE BASIC MEDICAL SCIENCES IN TENNESSEE. Robert A. Woodbury, *University of Tennessee School of Medicine*, Memphis, Tennessee. During the last two years, there has been a nation-wide decline in the number of graduate students enrolled in the basic medical sciences. These sciences are Human Anatomy, Physiological Chemistry, Physiology, Pathology, Bacteriology and Pharmacology. The Universities in the Southeast and in Tennessee have trained only a very few scientists in these fields. The probable factors which have contributed to this failure by these Universities will be discussed.

CONSERVATION THEN—CONSERVATION NOW. George R. Mayfield, *Vanderbilt University*, Nashville, Tennessee.

A REPORT ON THE NATIONAL SCIENCE FOUNDATION CONFERENCE FOR ASTRONOMY TEACHERS AT BERKELEY, CALIFORNIA. Mary W. Peters, *University of Tennessee*, Knoxville, Tennessee. At the Christmas meeting of the Astronomical Society, the first announcement was made of a conference for teachers of Astronomy, to be held at Berkeley, California, under the sponsorship of the National Science Foundation and the University of California. This conference was held in Berkeley from August 12 through September 10, 1954. Its purpose was to bring to Astronomy teachers current information in the special fields of Astronomy with stress upon research programs related to these fields. Particularly it aimed to serve teachers who had no close connections with institutions where research in Astronomy is carried on.

There were twenty-one official delegates from all parts of the country whose expenses were paid in part by the National Science Foundation. The delegates spent four weeks attending lectures from early morning until

late afternoon. Time was allowed for visits to the big observatories: Lick, Mt. Wilson, and Palomar. The lectures were given by outstanding astronomers among whom were Dr. Otto Struve, Dr. Bart Bok, Dr. Armand Deutsch and Dr. Peter Van de Kamp.

THE 1954 ECLIPSE OF THE SUN IN EUROPE. Karel Hujer, *University of Chattanooga*, Chattanooga, Tennessee.

#### SYMPOSIUM: "SOME PROBLEMS OF PHYSICAL CHEMISTRY AT ELEVATED TEMPERATURES"

HETEROGENEOUS EQUILIBRIA IN AQUEOUS SALT SOLUTION AT ELEVATED TEMPERATURES. C. H. Secoy, *Oak Ridge National Laboratory*, Oak Ridge, Tennessee. A discussion is presented of the phase behavior of aqueous solutions of common inorganic salts at temperatures as high as or higher than the critical temperature of water. Some qualitative generalizations of the effects of phenomena such as hydrolysis and volatility of components are made.

Two component systems are discussed in some detail, illustrative data for various systems being taken from work at Oak Ridge National Laboratory and from the literature. Examples will be given in which the salt shows complete miscibility, partial miscibility, or complete immiscibility with the super-critical fluid. Other examples are given in which the system must be treated as a three-component system.

Experimental techniques that have been employed and the experimental difficulties encountered are discussed briefly. Potential values of such studies for industrial application and for theoretical chemistry are described.

HIGH TEMPERATURE E. M. F. MEASUREMENTS. M. H. Lietzke, *Oak Ridge National Laboratory*, Oak Ridge, Tennessee. For many years water containing small amounts of dissolved impurities has been treated in boilers to run steam engines and steam turbines. Although the problem of boiler scale has been ever present in the utilization of steam, very little fundamental work has been done to elucidate the properties of aqueous solutions at elevated temperatures. With the advent of aqueous homogeneous reactors, however, it has become necessary to understand the behavior of aqueous solutions of varying concentration over wide temperature ranges.

One way to study aqueous solutions above 100°C is to make E. M. F. measurements. It should be possible in this manner to measure equilibrium constants of reaction; dissociation, hydrolysis, and solubilities of salts; and the activity of acids and water to relatively high temperatures. In order to make the measurements it is first necessary to develop two types of electrodes: reference electrodes and indicator electrodes. At the present time studies have been made of the Ag, Ag<sub>2</sub>SO<sub>4</sub>; Hg, Hg<sub>2</sub>SO<sub>4</sub>; Ag, AgCl; Hg, Hg<sub>2</sub>Cl<sub>2</sub>; and hydrogen electrodes to a temperature of about 250°C. It is still necessary to study the high temperature behavior of other types of electrodes, for example, metal, metal oxide electrodes and the glass electrode. These electrodes can then be applied to a study of solution phenomena above 100° C.

MASS SPECTROMETRY ABOVE 500° C. C. R. Baldock, *Oak Ridge National Laboratory*, Oak Ridge, Tennessee. Recently developed high temperature ion sources and related techniques make possible mass spectrometer studies and analyses of high melting point metals and refractory compounds. Sample sizes are often of the order of only a few micrograms, and the extensive chemistry of special sample preparation is essentially eliminated. Application of enriched isotopes in the high precision isotope dilution analyses for trace elements is greatly simplified.

CONDUCTIVITY, IONIC MIGRATION AND STRUCTURE OF MOLTEN SALTS. E. R. VanArtsdalen, *Oak Ridge National Laboratory*, Oak Ridge, Tennessee.

Despite the fact that molten salts are red hot and highly corrosive they are potentially useful as heat transfer media for high-temperature industrial operations, are used rather extensively in electrochemical process and possess properties which make them attractive as solvents for various reactions. Consequently, it is important that an understanding of their fundamental nature and reactions be obtained. Molten salts are highly concentrated electrolytic fluids and so are good conductors of electricity. Detailed measurements have been made of density and conductance for many pure liquid salts and a number of their mixtures from which the theoretically significant equivalent volume and equivalent conductance have been computed. These qualities allow one to draw interesting conclusions about the structure of molten salts and the movement of their constituent ions. Further evidence can be obtained from measurement of transference numbers during electrolysis, but the complicated experimental techniques make satisfying interpretation difficult. Perhaps the most direct evidence about ionic motion and structure of molten salts can be obtained at present from determination of diffusion coefficients by radio-tracer techniques. All of these methods are being used and their relation to one another will be discussed.

Experimental results are in agreement with theoretical conclusions that (1) molten salts have short range order resembling that of the crystal but lacking long range order and (2) the smaller ions are the better conductors of electrical current.

MUTUAL SOLUBILITY OF LIQUID METALS AND SALTS. M. A. Bredig, *Oak Ridge National Laboratory, Oak Ridge, Tennessee.*

A review of the history of the subject shows how the opinion of chemists vacillated in regard to the existence of true solutions, or of colloidal suspensions, of metals in fused salts, and in regard to the crystallization, from such molten mixtures, or solid subhalides such as  $\text{CaCl}$  having unusual stoichiometry or valence state. In the last decade, however, quantitative investigations of metal-salt phase equilibria, especially with alkali and alkaline earth metal systems, have established limits of mutual solubility and their variation with temperature. Even complete miscibility, i. e. miscibility in all proportions of metal to salt, has now been demonstrated to exist at moderately high temperatures. Interesting questions as to the atomic and electronic structure of such solutions arise and challenge the investigator to an attack not only by time-honored thermodynamic methods but also measurements of physical properties such as electrical conductivity, magnetic susceptibility, and absorption spectra.

#### ANNUAL BUSINESS MEETING OF THE ACADEMY

The business session of the sixty-fourth meeting of The Tennessee Academy of Science was called to order by the President at noon on November 26, 1954, in Room 200, Industrial Arts Building of George Peabody College for Teachers in Nashville. The Secretary read the minutes of the Executive Committee meetings of February 27, 1954 and November 25, 1954.

The President called for reports of the officers of the Academy.

*The Editor of The Journal of the Tennessee Academy* (1) made a plea for papers from each section of the Academy to be published in the Journal, (2) announced the plan for setting aside a portion of each issue of *The Journal* to be devoted to High School Science Teachers, (3) expressed thanks for the assistance of all those who had helped in transferring the editorship, especially Dr. Jesse M. Shaver.

The Secretary reported (1) a total membership of 638 members, (2) that during 1954, 102 members were dropped for non-payment of dues, 32 were dropped at their own request, (3) that a list of 62 candidates for membership was posted on the bulletin board. The Secretary also reported a total sum of \$147.16 available for research grants. The Secretary read a letter from Dr. Shaver expressing his appreciation for the purse made up by the membership of the Academy on the occasion of his retiring from the Editorship of The Journal.

The Treasurer made an interim report.

The President reported the personnel of all standing committees as follows:

*Resolutions:* Jesse M. Shaver, *Chairman*, Peabody College, John B. Bond, Austin Peay College, Richard Stevenson, East Tennessee State College.

*Nominating:* Paris B. Stockdale, *Chairman*, University of Tennessee, Arlo I. Smith, Southwestern at Memphis, R. T. Lagemann, Vanderbilt University.

*Fellows:* Carl Tabb Bahner, *Chairman*, Carson-Newman College, Sam Shoup, AEC, Oak Ridge; Ellis Rucker, Jr., Middle Tennessee State College.

*Constitutional Revision:* A. J. Sharp, *Chairman*, University of Tennessee, C. L. Baker, Southwestern at Memphis, Carl K. Seyfert, Vanderbilt University, Isabel H. Tipton, University of Tennessee.

*Auditing:* Mary W. Peters, University of Tennessee, Robert A. Laurence.

*Program:* Fred T. Wolf, Vanderbilt University.

*Local:* Claude S. Chadwick, *Chairman*, Arthur Cook, A. M. Holladay, Margaret L. Johnson, John Banks.

*Academy History:* George R. Mayfield, *Chairman*, Jesse M. Shaver, Hanor A. Webb.

*Planning:* Robert T. Lagemann, *Chairman*, Nashville, C. L. Baker, Memphis, N. W. Dougherty, Knoxville, Kenneth Fry, Chattanooga, Henry H. Hill, Nashville, Wilbur Kaye, Kingsport, Sam L. Nickey, Jr., Memphis, Cartter Patten, Chattanooga, A. J. Sharp, Knoxville.

*Membership:* Athens, LeRoy Martin; Chattanooga, R. J. Bradshaw, Jr., Winston Masscy, Allison Slagle; Clarksville, James L. Major, John B. Bond; Collegedale, Dr. Gaskell; Columbia, Jephtha R. Hall; Dayton, Miss Lou Ellen Rouch; Elizabethton, Hugo B. Hofmann; Gatlinburg, Arthur Stupka; Harrogate, Louis Lutz; Jefferson City, Carl Tabb Bahner, John T. Johnson; Johnson City, A. C. Graybeal; Kingsport, James G. McNally; Knoxville, Wm. Roger Rusk, Fred Norris; Memphis, M. L. MacQueen; Murfreesboro, Ellis Rucker, Jr.; Nashville, Ingram Bloch, Frances R. Bottum, Nelson Fuson, A. M. Holladay; Oak Ridge, Granvil C. Kyker; Sweetwater, Cecil B. Brown; Tullahoma, Cord H. Link.

*Committee on Fauna:* A. C. Cole, University of Tennessee.

*Committee on Flora:* A. J. Sharp, University of Tennessee.

*Tennessee Science Talent Search:* James L. Major, *Chairman*, Calvin A. Buehler, Howard C. Kirksey, Miss Katherine Matthew, Charles S. Shoup, Hanor A. Webb.

*Collegiate Division:* C. L. Lundberg, Vanderbilt University.

*Junior Academy:* Frances R. Bottum.

*Coordinating:* Dewey Large, ORINS, Elmore Holmes, Memphis, Conrad Bates, T.S.T.A., Woodrow Wyatt, Knoxville, Roger Rusk, University of Tennessee.

*Engineering Section:* G. H. Lundberg, Vanderbilt University, F. L. Lewis, Vanderbilt University, N. W. Dougherty, University of Tennessee, Walter Graham, Vanderbilt University.

*Industrial Scientist:* Wilbur Kaye, Tennessee Eastman.

All reports were accepted by the Academy.

Dr. Frances R. Bottum, Dr. George R. Mayfield and Dr. Hanor A. Webb were elected honorary members of the academy by acclamation.

The 62 applicants for membership were elected by unanimous vote. The President called for Committee reports.

#### REPORTS OF COMMITTEES

*Fellows Committee.* It was voted to add the name of Ellis Rucker, Jr. to the list of members to be recommended as Fellows of the A.A.A.S. Dr. Hanor A. Webb was appointed to take Dr. Rucker's place on the Committee. The amended report was accepted and the following persons recommended as Fellows of the A.A.A.S.:

Arnold, W. A.	McNally, James G.
Dougherty, Dean N. W.	Neilson, A. H.
Fuson, Nelson	Parker, Malcolm V.
Hasek, Robert E.	Pollard, Arthur L.
Holladay, A. M.	Rucker, Ellis Jr.
Hollister, Paul	Wiebe, A. H.
Keim, Christopher P.	Woodruff, N. H.
Lagemann, Robert T.	

*Constitutional Revision Committee.* The proposed revised Constitution was posted on the bulletin board for examination, a copy to be sent to each member immediately after the 1954 meeting. Suggestions for changes are to be submitted in writing before the January meeting of the Executive Committee, so that the revised Constitution can be voted on at the 1955 meeting of the Academy.

*Program Committee.* A plea for abstracts of the papers presented at the 1954 meeting was made.

*Science Talent Search Committee.* The Science Talent Search Committee reports as follows:

This is the 14th year a National Science Talent Search has been promoted by Science Service and Science Clubs of America. It is financed by Westinghouse Company.

Nine years ago The Tennessee Academy of Science initiated a Tennessee Science Talent Search to parallel the National Contest.

Each spring the Science Talent Search Committee selects the most outstanding entries in the National Science Talent Search from Tennessee. This list with full information is sent to all colleges in Tennessee and to colleges designated by the winners in the contest. Articles are written for newspapers in the state and magazine articles are prepared.

For six years the committee has kept in touch with the winners in each Search. Each year before Christmas, letters and questionnaires are sent out to all former winners. Most of the questionnaires are filled out and returned. Many letters are received from the winners. Most of them have made real progress and are pursuing the courses they planned when they were seniors in high school. Many have expressed a desire to do something worthwhile which will help mankind. Many letters state appreciation for what The Tennessee Academy of Science has done for them in securing scholarships, showing interest and confidence in them. They are proud that the Academy of Science continues its interest in them and hope to become worthy of its confidence in them.

Signed, James L. Major, *Chairman*, Calvin A. Buehler,  
Howard C. Kirksey, Miss Katherine Matthew, Charles S.  
Shoup, Hanor A. Webb.



All Committee reports were accepted.

The representative to the Council of Academies of the A.A.A.S. made a report to be printed in its entirety in The Journal.

Isabel H. Tipton was elected Academy representative to the A.A.A.S. meeting in 1955, expenses to be paid by the Tennessee Academy.

The nominating Committee submitted the following slate:

*President:* Frederick T. Wolf, Vanderbilt.

*Vice President:* C. S. Chadwick, George Peabody College.

*Secretary:* Isabel H. Tipton, University of Tennessee.

*Treasurer:* James W. White, University of Tennessee.

The Secretary was instructed to cast a unanimous ballot for these officers.

The meeting was adjourned.

The section officers for 1955 are:

#### BOTANY SECTION:

*Chairman*—Frank Barclay, East Tennessee State College.

*Vice Chairman*—Elsie Quarterman, Vanderbilt University.

*Secretary*—H. R. DeSelm, Middle Tennessee State College.

*Journal Representative*—Elsie Quarterman, Vanderbilt University.

#### CHEMISTRY SECTION:

*Chairman*—W. W. Grigorieff, Oak Ridge.

*Secretary*—E. R. Van Artsdalen, Oak Ridge National Laboratory.

*Journal Representative*—Carl M. Hill, Tennessee A & I College.

#### GEOLOGY AND GEOGRAPHY SECTION:

*Chairman*—Richard G. Stearns, Tennessee Division of Geology, Nashville.

*Journal Representative*—W. B. Jewell, Vanderbilt University.

#### MATHEMATICS SECTION:

*Chairman*—H. J. Dark, David Lipscomb College.

*Secretary*—M. G. Boyce, Vanderbilt University.

#### PHYSICS-ASTRONOMY SECTION:

*Chairman*—Nelson Fuson, Fisk University.

*Secretary*—James Lawson, Tennessee A & I College.

*Journal Representative*—Roger Rusk, University of Tennessee.

#### ZOOLOGY SECTION:

*Chairman*—H. B. Crouch, Tennessee A & I College.

*Secretary*—Leo Weeks, Austin Peay State College.

### BOTANY SECTION

EPIPHYTISM IN THE GREAT SMOKY MOUNTAINS. Aaron J. Sharp, *University of Tennessee*, Knoxville, Tennessee.

Seed-bearing epiphytes, uncommon in temperate North America, are not rare in sections of the Great Smoky Mountains. *Rhododendron Maximum*, *Picea rubens* and *Tsuga canadensis* are common epiphytes growing on *Betula alleghaniensis*. Seed production has been noted for epiphytic *Rhododendron* and red spruce.

A NEW SPECIES OF THE GENUS PLANKTOSPHAERIA SMITH. Walter R. Herndon, *Middle Tennessee State College*, Murfreesboro. From a number of green algae isolated from soil from Jamaica, British West Indies, several interesting organisms have been selected for critical study in cultures. Among these is an alga which possesses all of the recently redefined generic attributes of *Planktosphaeria* Smith, namely: 1. Vegetative cells with separate chromato-

phores 2. Pyrenoids present in chromatophores and 3. Zoospores which become spherical at quiescence and which possess two flagella of equal length. However, the zoospore morphology of the Jamaican isolate differs distinctly from that of the only known species of the genus, *P. gelatinosa* Smith; the zoospores of the latter are cylindrical and possess a parietal chromatophore and an anterior stigma, whereas those of the former are largely flattened and possess a posterior chromatophore and a posterior stigma. The Jamaican isolate is also distinguished by larger vegetative cells and by the frequent occurrence of internal as well as parietal plastids. For these and other reasons, apparent when careful comparison of the two organisms is made, it is concluded that the Jamaican isolate merits recognition as a previously undescribed species and will, subsequently, be formally described as *Planktonisphaeria botryoidea* sp. nov.

NOTES ON THE GENUS HEUCHERA IN TENNESSEE. James P. Gillespie, *University of Tennessee*, Knoxville. The taxa of *Heuchera* in Tennessee are: *Heuchera americana* vars. *typica*, *brevipetala*, *interior*, and *hirsuticaulis*; *Heuchera parviflora* var. *Rugelii*; *Heuchera villosa* vars. *typica*, *intermedia*, and *macrorhiza*; *Heuchera longiflora* var. *aceroides*. *Heuchera parviflora* var. *Rugelii* seems to be limited almost entirely to the rockhouses of the Appalachian Plateau. *Heuchera villosa* var. *typica* and *Heuchera villosa* var. *macrorhiza* seem to have hybridized forming the var. *intermedia* in the eastern part of the State. Villous forms believed to be *H. americana* var. *interior* and *H. americana* var. *hirsuticaulis* are reported for the first time from east Tenn.

One specimen of *H. americana* with very long, narrow petals is reported from Knox County.

EARLY PLANT SUCCESSION IN ABANDONED FIELDS IN THE CENTRAL BASIN OF TENNESSEE. Elsie Quarterman, *Vanderbilt University*, Nashville. Plant succession in abandoned fields in the Central Basin of Tennessee begins with a tall herb stage that lasts until the 4th or 5th year. At that time, *Andropogon* becomes co-dominant with *Aster* and *Solidago* which remain from preceding years. *Aster* and *Solidago* are never replaced with *Andropogon*, but may increase in importance along with the grass until shaded out by an elm and hackberry about 20 to 25 years after abandonment. Pasturing seems to increase the abundance of *Andropogon* and red cedar and to decrease the abundance of tall herbs, elm and hackberry.

SUPPLEMENTARY INFORMATION ON THE WOODY PLANTS OF TENNESSEE. Royal E. Shanks, Botany Department, *University of Tennessee*. While a number of new country records were added to the woody plant checklist during the year, only two names were added to the list: *Crataegus penita* Beadle, credited to southeastern Tennessee by Little, and *Hypericum calycinum* L., escaped and naturalized in Knox Co. A collection of *Acer rubrum* var. *drummondii* (H. & A.) Sarg. from Rutherford Co. by H. K. Svenson is a notable extension of range from West Tennessee. Records from the counties of north-eastern Tennessee are now especially complete due to the persistent efforts of R. L. James. Distribution records for most woody plants are sufficiently complete that they provide a useful basis for sub-dividing the state into floristic regions.

NOTES ON THE HYPERICACEAE OF TENNESSEE. James P. Gillespie, *University of Tennessee*, Knoxville. The species of *Hypericum* and *Ascyrum* in Tennessee are discussed from a taxonomic and geographical point of view. These include: *Ascyrum stans*, *A. hypericoides* and *A. hypericoides* vars. *multicaule* and *oblongifolium*. *Hypericum perforatum*, *H. punctatum* and its var. *pseudomaculatum*, *H. mitchellianum*, *H. spathulatum*, *H. frondosum*, *H. densiflorum*, *H. densiflorum* var. *lobocarpum*, *H. nudiflorum*, *H. adpressum*, *H. ellipticum*, *H. dolabriforme*, *H. sphaerocarpum*, *H. denticulatum*, and its vars. *recognitum* and *acutifolium*, *H. setosum*, *H. mutilum*, *H. gymnanthum*, *H. canadense*, *H. Drummondii*, *H. gentianoides*, *H. virginicum*,

and its var. *Fraseri*, *H. tubulosum*, and its var. *Walteri*, *H. adpressum*, *H. glomeratum*, and *H. Buckleyi*.

VARIATION IN TWO OHIO PRAIRIE PLANT SPECIES. H. R. DeSelm, *Middle Tennessee State College*, Murfreesboro.

*Andropogon gerardi* and *A. scoparius* are representatives of the Ohio prairie, the latter characteristic of certain areas both south and north of the glacial border. These species have been studied for evidence of population divergence resulting from geographic isolation.

Comparisons have been made of chromosome number and configuration, "seed" germination, certain morphological characteristics of population samples, and growth of sod transplants.

REPORT OF FLORA COMMITTEE. A. J. Sharp, University of Tennessee, Knoxville.

#### CHEMISTRY SECTION

APPARATUS FOR THE STUDY OF DIPOLE MOMENTS. Albert L. Myers, H. L. Curry, Jr., Thomas Eskew, Jr., and Hugh C. Finklea, *Carson-Newman College*, Jefferson City. We have constructed a heterodyne beat apparatus for the determination of dipole moments in benzene solution. Electronic kits were used wherever possible. The measuring cell and the method of its use will be described. The purification of the benzene will also be described. This apparatus has been used to determine the dipole moments of nitromethane, nitroethane, and 2-nitropropane. The possible adaptation of this equipment to a physical chemistry laboratory experiment will be discussed.

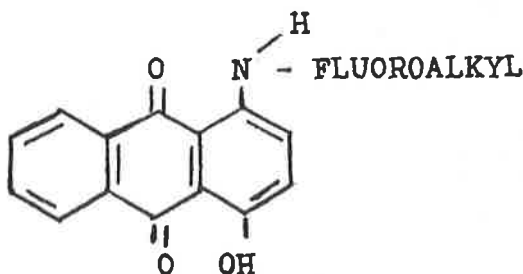
CHROMATOGRAPHY OF GASES AND VOLATILE LIQUIDS. H. W. Patton, J. S. Lewis, and W. I. Kaye, *Tennessee Eastman Company*, Kingsport. Gas chromatographic techniques were used to study the potentialities of selective absorption and partition methods for the separation and analysis of gases and volatile liquids.

Methods involving elution by hydrogen, nitrogen, or carbon dioxide from columns containing charcoal, silica gel, or alumina provided excellent separation of hydrocarbons and other nonpolar materials.

Gas chromatographic elution is simple, accurate, and very effective for the identification and determination of the components of many gaseous and liquid mixtures, particularly of hydrocarbons.

PREPARATION AND PROPERTIES OF FLUORINATED ANTHRAQUINONE DYES. J. B. Dickey, E. B. Towne, M. S. Bloom, G. J. Taylor, D. J. Wallace, John Sagal, Jr., M. A. McCall, and D. G. Hedberg. *Tennessee Eastman Company*, Kingsport. The substituted aminoanthraquinones in general are excellent dyes for cellulose acetate. This paper describes the synthesis of two series of dyes which illustrates the effect of (1) introducing fluorine atoms into the alkyl group of alkylamino-anthraquinones and (2) introducing a  $CF_2$  group into the nucleus of aminoanthraquinones.

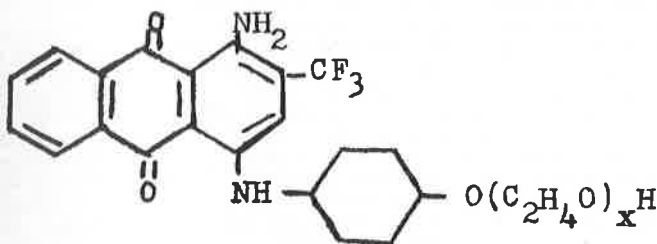
The first series of dyes contains fluoroalkylamino groups



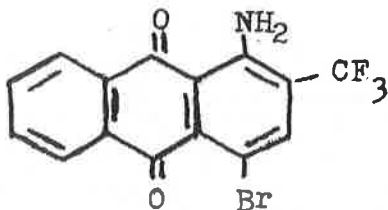
and was prepared by reacting 1, 4, 9, 10-anthraquinone (leucoquinizarin) with several fluoroalkylamines, some of which are new compounds. These dyes are light- and gas-fast and vary from pink to violet in shade.

The fluoroalkyl amines used in this series of dyes were prepared by reacting fluoroalkyl halides with ammonia. The series includes  $\text{CF}_3\text{CH}_2\text{NH}_2$ ,  $\text{CHF}_2\text{CH}_2\text{NH}_2$ ,  $(\text{CF}_3)(\text{CH}_3)\text{CHNH}_2$ ,  $\text{CF}_3\text{CH}_2\text{CH}_2\text{NH}_2$ ,  $\text{CHF}_2\text{CH}_2\text{CH}_2\text{NH}_2$ ,  $\text{CH}_2\text{CF}_2\text{CH}_2\text{NH}_2$ , and  $\text{CH}_3\text{CF}_2(\text{CH}_2)_3\text{NH}_2$ .

The second series of dyes contains a  $\text{CF}_3$  group in the anthraquinone nucleus:



These dyes were prepared by reacting



with amines, particularly aminophenyl polyglycol ethers. Dyes in this series are also light- and gas-fast but are blue in shade. The preparation of the necessary intermediates is given.

Introduction of fluorine atoms into the alkyl groups of alkylaminoanthraquinone dyes shifts the color and, in some cases, enhances the light- and gas-fastness. Introduction of a  $\text{CF}_3$  group into the nucleus of an aminoanthraquinone dye also shifts the color and, in some cases, enhances light- and gas-fastness.

Both types of fluorinated anthraquinone dyes give deep, bright shades, especially on cellulose acetate fabrics.

ACCELERATOR TARGETS FROM ENRICHED STABLE ISOTOPES. P. S. Baker, F. R. Duncan, and H. B. Greene, *Oak Ridge National Laboratory*, Oak Ridge. Increased interest in the utilization of enriched stable isotopes as targets in the various types of particle accelerators has led to the development of a series of special techniques for the preparation of suitable isotopic forms for targets and target coatings. Owing to the limited availability of many of the isotopes, ordinary industrial methods are inapplicable, and it becomes necessary to devise special schemes for small-scale work and efficient recovery. Electrochemical, casting, powder metallurgy, thermal reduction, and flame-spraying techniques are used, but on a very small scale when compared to those usually encountered.

The preparation of special targets or target materials of lithium, chromium, iron, nickel, boron, cadmium, and silicon will be discussed briefly, including both the chemistry involved in any conversions, and the actual techniques used in producing the targets. Other applications of these special procedures will also be mentioned.

THE HISTORY AND CURRENT STATUS OF THE ATOMIC ENERGY COMMISSION—OAK RIDGE NATIONAL LABORATORY STABLE ISOTOPE PROGRAM. C. P. Keim, *Oak Ridge National Laboratory*, Oak Ridge. In late 1945 the first opportunities came for those engaged in the electromagnetic separation of uranium isotopes at Oak Ridge to investigate the separation of the isotopes of other elements. Progress in enriching in at least gram quantities the isotopes of nearly fifty elements has been rapid and the applications of these isotopes in research have been numerous. Several hundred papers from over fifty laboratories have appeared in the open literature reporting on stable isotope research. Over two thousand shipments of electromagnetically enriched isotopes have been made. Among the most prominent investigations in which these isotopes have been utilized are those in nuclear physics such as cross section measurements, resonance studies, hyperfine spectroscopy, measurement of nuclear spin and magnetic moments, etc. Many new radioactive isotopes have been produced and identified from enriched stable isotopes. The use of stable isotope targets in the cyclotron makes it possible to produce at moderate costs useable isotopes of radioisotopes not previously available. The application of stable isotopes in dilution analysis offers considerable promise now that a wide variety of stable isotopes are available and mass spectrometer techniques have been developed. Electromagnetically enriched isotopes are obtained from Oak Ridge National Laboratory following Atomic Energy Commission approval of the request from the user.

SPECTROPHOTOMETRIC ESTIMATION OF CHLOROPHYLL IN THE LEAVES OF FLUE CURED AND TURKISH VARIETIES OF TOBACCO. Frederick A. Wolf and Frederick T. Wolf, Department of Botany, *Duke University*, Durham, N. C., and Department of Biology, *Vanderbilt University*, Nashville. The chlorophyll content of the green leaves of twelve tobacco varieties has been determined by a spectrophotometric method. Total chlorophylls vary from 0.54 to 1.66 mg. per gram fresh weight, flue cured types in general having more chlorophyll than Turkish types. No significant difference was found in the percentage of chlorophyll *a* among varieties (68.4-70.8 per cent). In the mature leaves of seven flue cured, burley and dark fired varieties, the total chlorophylls decrease an average of 46.6 per cent. In the leaves of these same varieties yellowed preparatory to curing, 73.6 per cent of the original chlorophyll has been destroyed. The decrease is most pronounced in flue cured types. Accompanying the changes which occur in mature and yellowed leaves is a preferential destruction of chlorophyll *a*, which constitutes 69.8 per cent of the total chlorophylls in green leaves, 61.8 per cent in mature leaves, but only 44.2 per cent in yellowed leaves.

SOME ASPECTS OF PHENOTHIAZINE CHEMISTRY. Samuel P. Massie, *Fisk University*, Nashville. Phenothiazine, or thiodiphenylamine, is an interesting heterocyclic organic molecule. It has been of interest as the parent compound of dyestuffs, such as methylene blue, since 1875, but recently, interest has been greatly stimulated by the discovery that certain of its derivatives are excellent drugs and one drug, chlorpromazine, is the so-called "wonder" drug of 1954.

Derivatives of phenothiazine may be synthesized chiefly by (1) ring closure of diphenylamines; (2) ring closure of diphenyl sulfides; (3) rearrangement of *o*-amino-sulfides; (4) substitution of the amino nitrogen; (5) oxidation or reduction of the sulfur linkage.

This paper will discuss these varied methods of synthesis. There will also be briefly discussed some of the more important drugs derived from phenothiazine.

THE SUMMER CONFERENCE TEACHING PROGRAMS OF THE AMERICAN CHEMICAL SOCIETY. Samuel P. Massie, *Fisk University*, Nashville. In 1950, a group of college chemistry teachers, greatly concerned about the problems of teaching general chemistry, and centered around the Committee on Teaching

of the Division of Chemical Education of the American Chemical Society, under the guidance of Dr. Otto M. Smith, met at Oklahoma A & M College, Stillwater, Oklahoma, to discuss some of their common problems. It was called a workshop. There were about 30 teachers.

This meeting was so successful that a second meeting was scheduled for 1951 in Stillwater. The horizon was expanded to include Qualitative Analysis. The third meeting was held at Stillwater in 1952, wherein it was decided to spread out. In 1953 the host institutions were Pennsylvania State College in the East and California Institute of Technology in the West.

1954 saw many new innovations. First, there were three conferences, two of which were 7-10 day workshops are the first 5-week Institute. Secondly, they touched new areas, North Carolina in the South, Kenyon College in the Midwest, Wyoming in the Rocky Mountain section. Thirdly, they touched new area Organic Chemistry and Physical Chemistry in addition to General and Analytical Chemistry. And, fourth, high school teachers were invited and participated.

What for 1955? One of the places selected is Fisk University. A discussion of the proposed program will be given.

#### GEOLOGY-GEOGRAPHY SECTION

STABILIZING A LANDSLIDE ON THE SERRA DE MAR IN BRAZIL. Portland P. Fox, Cleveland, Tenn. This paper describes the character of the material in slide, local geology, rate of movement, causes and methods used to stabilize about one half million cubic meters of material near the largest power plant in Brazil.

THE SIGNIFICANCE OF PYRRHOTITE-BEARING PEBBLES IN THE SOUTHERN APPALACHIANS. William T. Hill, *University of Tennessee*, Knoxville. Throughout the Southern Appalachians prominent pebble horizons occur in many formations in the stratigraphic section. An investigation of these pebbles revealed that they are pyrrhotite-bearing while the matrix associated with them is practically void of the sulphide. Other investigations have revealed that the fire-grained sediments have detrital garnet, tourmaline, and chlorite quartz which indicates that the sediments, at least in part, were derived from rocks which had attained a stage of metamorphism sufficiently high enough to develop garnet. The highly mineralized pebbles occurring throughout the stratigraphic column are unexplainable in the light of present ideas concerning the ages of mineralization of the Ocoee and older rocks. Comparison of the mineralized vein quartz pebbles to quartz veins in the Ocoee formation reveals a strikingly similar mineralogy.

The writer tentatively suggests that the pyrrhotite-bearing pebbles were derived from a common pre-Cambrian source, probably the Ocoee series and similar rocks. Repeated uplift of the pre-Cambrian rocks during successive geologic periods resulted in the erosion and deposition of the mineralized pebbles.

BODIES OF IRON ORE MATERIALS IN THE KNOX DOLOMITE, SULLIVAN COUNTY, TENNESSEE. Berlen C. Moneymaker, TVA, Knoxville.

TRAVERTINE AND DEPOSITS IN EAST TENNESSEE. Harold K. Brooks, *University of Cincinnati*, Cincinnati, Ohio.

Terraced travertine and marl deposits near Holston, Dandridge and Jefferson City, Tennessee are described and discussed. Studies of other deposits in the Valley and Ridge province of Tennessee and Virginia must be completed before definite conclusions on their origin and significance can be made.

STRATIGRAPHY AND REVISED NOMENCLATURE OF PENNSYLVANIAN STRATA IN THE SOUTHERN TENNESSEE COAL FIELD. Edward T. Luther and John W. Jewell, *Tennessee Division of Geology*, Nashville.

POST-PALEOZOIC STRATIGRAPHY OF WEST TENNESSEE AND ADJACENT AREAS OF THE UPPER MISSISSIPPI EMBAYMENT. Richard G. Stearns, Tennessee Division of Geology, Nashville, and Clarence Armstrong, U. S. Geological Survey, Memphis.

AN OCCURRENCE OF A PLEUROPTERYGIAN SHARK IN THE CHATTANOOGA SHALE OF TENNESSEE. Stuart W. Maher, *University of Tennessee*, Knoxville, and David H. Dunkle, *U. S. National Museum*, Washington, D. C.

LOWER MISSISSIPPIAN ROCKS AT KENTUCKY DAM AND RESERVOIR. Portland P. Fox, Cleveland, Tenn. and Leland F. Grant, TVA, Knoxville.

THE CHATTANOOGA BENTONITE AND ITS BEARING UPON THE DOWELLTOWN-GASSAWAY CONTRACT. Harry J. Klepser and Paris B. Stockdale, *University of Tennessee*, Knoxville. The Chattanooga bentonite is a remarkably persistent but thin stratigraphic unit, occurring within the upper two feet of the Dowelltown member of the Chattanooga formation in the central portion of the Eastern Highland Rim in Tennessee. It occurs in the area east of a northeast-southwest trending, irregular line approximately parallel to the Highland Rim escarpment, southward from the vicinity of the Flynn Creek area in southern Jackson County, to the vicinity of Manchester, Coffee County. Although the complex mineral content varies somewhat from place to place, the heavy residues reveal an undoubted volcanic origin.

Throughout most of this area the position of the bentonite is slightly less than one foot to two feet below the Dowelltown-Gassaway contact, but as one approaches the limit of bentonite occurrence, the bentonite appears closer and closer to the contact, until at the very limit of its extent it is at the contact or within one tenth of a foot below it.

The paper suggests two possible explanations for the absence of the bentonite in the areas to the north of Flynn Creek, to the south of Manchester, and west of the irregular line essentially parallel to the Highland Rim escarpment.

(1) The bentonite was originally more extensive, and as suggested by Hass for the Woodbury area, was removed where the bentonite is absent, the Dowelltown-Gassaway contact represents an unconformity.

(2) The present extent of the bentonite represents essentially the original extent of the volcanic ash deposit, and thus the bentonite is absent not because of erosion, but because of non-deposition. (This paper is presented with permission of the United States Atomic Energy Commission)

#### MATHEMATICS SECTION

SOME NEW APPROACHES TO THE CALCULUS. M. G. Boyce, *Vanderbilt University*, Nashville.

HOW TO MAKE CONIC EQUATIONS THAT ARE EASILY RECTIFIED. T. C. Carson, *East Tennessee State College*, Johnson City.

THE INFLUENCE OF MATHEMATICS ON THE PHILOSOPHY OF ARISTOTLE. R. H. Moorhman, *Tennessee Polytechnic Institute*, Cookeville. For a number of years the writer has been trying to study the influence of mathematics on philosophy by studying the most outstanding men who have been famous both as mathematicians and as philosophers. Aristotle, like other mathematicians who philosophize, had the concept of a *universal mathematics*. With most mathematicians this has been the theoretical application of mathematics to every phase of life, but Aristotle seems to have been more cautious in his extension of mathematics. Aristotle invented the syllogism as a method of reaching conclusions by means of deductive reasoning. This became the method of proof used in geometry and it was used extensively in philosophy from that time. His Law of the Excluded Middle and Law of Contradiction were used extensively in mathematics and in philosophy. Mathematics seems to have been related to his treatment of all the major problems of philosophy. The influence of mathematics on his philosophy was not as great as in the case of other mathematical philosophers, because

he thought the things dealt with by mathematics were not real, while the things dealt with by philosophy were real.

## PHYSICS-ASTRONOMY SECTION

THE INFRARED SPECTRUM OF CRYSTALLINE SODIUM NITRATE. Robert T. Lagemann, *Vanderbilt University*, Nashville.

The infrared spectrum of crystalline sodium nitrate has been examined from 2 to 25 microns on a Perkin-Elmer, Model 25, prism spectrometer. The various bands have been correlated with the vibration modes predicted on the assumption of  $D_{3h}$  symmetry for the  $NO_3$  ion. In contrast with certain earlier work, no doubling of the absorption peaks has been found. Correlation of this work with the prior Raman results will be discussed.

INFRARED SPECTROSCOPIC STUDIES OF CARCINOGENIC COMPOUNDS. Nelson Fuson, *Fisk University*, Nashville. The classical method of determining carcinogenic potency is by biological means. It would be highly desirable to find a physical means which might be of some indication of the carcinogenic properties of a compound. This paper will report the preliminary results of work at Fisk University on two series of compounds which include both carcinogenic and non-carcinogenic compounds, namely the methyl benzanthracenes isomers and the methyl benzo(c)phenanthrene isomers.

A DIFFERENTIAL DOUBLE EXPOSURE METHOD FOR SPECTROSCOPIC ANALYSIS. Robert L. Steiner and Isabel H. Tipton, *University of Tennessee*, Knoxville, and *Oak Ridge National Laboratory*, Oak Ridge. A method for the simultaneous analysis of volatile and relatively involatile elements has been worked out for the analysis of soft biological tissue ash using cathode layer excitation.

A modified Hartman diaphragm was used with a Bausch and Lomb quartz Littrow spectrograph. The diaphragm masks half the slit height after a short exposure (10 sec) to produce a spectrum having a short exposure and a total burn exposure from the same sample.

Elements volatilizing similarly to Ag, Pb, Zn, etc. are analyzed from the short exposure. Masking of analysis lines by background is prevented and sensitivity is increased for volatile elements.

Elements volatilizing similarly to Mn, Cr, Ni, etc. are analyzed from the total burn exposure.

ON TEMPERATURE RECOVERY IN SUPERSONIC FLOW (INVITED PAPER). Heinrich Raam, *Aro Incorporated*, Tullahoma. When a gas stream is decelerated to rest, its temperature increases by transformation of the kinetic energy into heat energy, this process is called temperature recovery. The higher the gas stream velocity is, the more pronounced the temperature increase will be, and is therefore of particular importance at supersonic speeds. A missile flying in still air will heat the air at the impact point accordingly. The heating of the air at the other sections of the surface is governed by a more complicated law. Here friction heat produced and heat carried away by conduction into the air are brought to an equilibrium that leads to surface air temperatures that may be higher or lower than the impact point temperature depending on the magnitude of a material constant, the Prandtl number. In addition the temperature recovery is a function of the kind of boundary layer encountered. Turbulent layers lead to higher recovery factors than laminar layers. Similar temperature rises occur in shock waves which represent an abrupt transition from supersonic subsonic speed. Then shock waves are produced in so called shock tubes, the temperatures next to the shock wave can reach 20,000° Centigrade and more.

DETERMINATION OF THE THERMODYNAMIC PROPERTIES OF LIQUID CHLOROETHANE. James W. Gilbert, *Middle Tennessee State College*, Murfreesboro. The speed of sound in liquid chloroethane ( $C_2H_5Cl$ ) was measured by means of an ultrasonic interferometer, at various temperatures in the range from



-14°C. to +12°C. (the boiling point is approximately 12.3°C.). Density measurement were also made at various temperatures within the same temperature range, with calibrated pycnometers. (No density measurements were found in the literature for temperatures below zero degrees centigrade, and considerable disagreement was found among determinations at higher temperatures.) By combining these measurements, then, with values of the heat capacity at constant pressure,  $C_p$ , found in the literature, it was possible to compute, by means of well known relationships, the adiabatic and isothermal compressibilities, coefficient of expansion, ratio of heat capacities, and finally the heat capacity at constant volume,  $C_v$ .

A MECHANICAL ANALOGY FOR DETERMINING ELECTRON TRAJECTORIES. Ray Kinslow, *Tennessee Polytechnic Institute*, Cookeville. Many practical electronic devices utilize crossed magnetic and electrostatic fields, but only the very simplest of cases may be analyzed by analytical methods. In this paper there is developed a mechanical analogy which shows that under certain conditions the motion of the end of a gyroscope axis is the same as that of an electron in combined fields. The desired path of the electron is determined by photographing a small light fastened to one end of the moving gyroscope axis while the other end is moving in a model of the electrode configuration. The gyroscope analogy was used in studying the phenomenon of negative transconductance in crossed fields under a TAS-AAAS research grant.

A SUMMARY OF KNOWN ELEMENTARY PARTICLES. W. G. Holladay, *Vanderbilt University*, Nashville. Since World War II a number of laboratories throughout the world have made contributions to the growing list of elementary particles, the existence of which for the most part was unexpected. These newly-discovered particles have very short half-lives, i.e., they very rapidly break up into lighter particles. Besides the electron, positron, photon, neutrino, proton, and neutron, we know today of the following particles:

Particle	Mass (In units of the electron mass)	Half-Life
Mu meson	209	$10^{-6}$ sec.
Pi meson	273	$2 \times 10^{-8}$ sec.
	266	$\ddagger 10^{-14}$ sec.
Tau meson	near 970	$\ddagger 10^{-9}$ sec.
Theta meson	near 970	$\ddagger 10^{-9}$ sec.
Kappa meson	$\ddagger 900-1200^*$	$\ddagger 10^{-9}$ sec.
Lambda particle	2190	$3 \times 10^{-10}$ sec.
Sigma particle	2350	$\ddagger 10^{-10}$ sec.

Other particles are suspected, but the above are the best established. These particles are manufactured in high energy collisions (high energy obtained either from cosmic radiation or by large accelerating machines), and have been seen in cloud chambers and in photographic emulsions, pictures of which will be shown. These new particles may hold the key with regard to the fundamental question of the nature of nuclear forces.

\* (The symbol  $\ddagger$  means "in the neighborhood of.")

A 2800° C. ION SOURCE USED IN THE COLLECTION OF THE STABLE ISOTOPES OF THE Pt AND Pd GROUP OF ELEMENTS. W. A. Bell, Jr., C. V. Ketron, L. O. Love, and C. E. Normand, *Oak Ridge National Laboratory*, Oak Ridge. The collection of gram quantities of the isotopes of Pd, Pt, Ru, and Ir has been accomplished using the ORNL production-type mass spectrographs. The design and development of a source capable of heating small (ten gram) quantities of the elements to approximately 2800° C. is discussed.

SOME PROPERTIES OF NUCLEAR SHELL STRUCTURE. Ingram Bloch and Yu-Chang Hsieh, *Vanderbilt University*, Nashville.

The occurrence of particularly stable and symmetric nuclei containing certain "magic" numbers of protons or neutrons has in the past been accounted for by a rather contrived nuclear model in which a few particles moved under the influence of all the others as if the latter were stationary. Recent work at Vanderbilt promises to account for the "magic" numbers without ignoring the motion of any of the particles in the nucleus.

PROBLEMS OF LONGITUDE IN EARLY YEARS OF THE ROYAL OBSERVATORY IN GREENWICH. Karel Hujer, *University of Chattanooga*, Chattanooga.

TWO SIMPLE LABORATORY EXERCISES FOR INTRODUCTORY ASTRONOMY. Mary W. Peters, *University of Tennessee*, Knoxville.

The introductory astronomy course offered at the University of Tennessee carries laboratory credit to satisfy the physical science requirement of the Liberal Arts College. The course has no prerequisites, and the work must be designed with this fact in mind. There are a few laboratory manuals published for such courses and for the past few years I have used one of these. Each year I found I was making changes in the exercises used and substituting in whole or in part for material requiring knowledge of mathematics and physics unknown to my students other material.

Two exercises which I have devised illustrate types of measurements that are necessary in astronomy. One is a diffraction grating experiment to find the length of a particular light wave, a very common experiment but one we do in an extremely simple fashion. The other is one in which we measure the parallax of a faint light source against a very distant background.

The grating experiment accomplishes several things. It gives every student an opportunity to see the spectrum of light source in several orders, making use of a number of different lamps the gross differences in the spectra are obvious, and for a few of the principal lines the wave lengths can be obtained with reasonable accuracy. We use similar triangles here with no mention of trigonometry.

For our exercise in parallax we use a transit to sight on a faint lamp about 45 feet away. The lamp is mounted in front of a window which has a distant view. After measuring the parallax and calculating the distance from our base line to the lamp, we measure this distance with a tape line just to make the students feel good. Actually the accuracy of the transit scale is probably better than the tape line!

EXPEDITIONS TO STUDY THE 1954 SOLAR ECLIPSE. Edward W. Burke, Jr., *King College*, Bristol. The Spectroscopy group of the University of Wisconsin Physics Department, and the University Astronomy Department each sent expeditions to Mellen, Wisconsin, to study the June 30, 1954 Solar Eclipse.

Attempts to study the Fe XIV line 5303 in the solar corona were unsuccessful. The Astronomy Department group studied darkening on the limb of the sun. Color and black and white slides of the eclipse and a moving picture of the eclipse will be shown.

#### ZOOLOGY SECTION

FISH PRODUCTION OF BEDFORD LAKE AS INFLUENCED BY A SIPHON. Norman G. Benson, *Tennessee Game and Fish Commission*.

Physical and chemical data were collected from Bedford Lake, Bedford County, Tennessee, during 1953 and 1954 relative to the installation of a siphon to increase fish production. This lake stratified by May. By September the hypolimnion was within 12 feet of the surface. Dissolved phosphorous disappeared from the epilimnion and thermocline in midsummer but was .090 p.p.m. in the hypolimnion. For future management it is suggested that the siphon be used only during the spring flood period to hasten the development of phyto-plankton in the epilimnion.

Prior to the installation of the siphon, a leak in the dam exerted an influence similar to the siphon. A complete record of the fish harvest from 1949 to 1954 showed that bluegills and largemouth bass increased in numbers

while black crappie and other species decreased. No definite relationship between fish production and lake stratification as influenced by drawing off the hypolimnion was found.

INFLUENCE OF THIOPIENTAL SODIUM ANESTHESIA AND OF PENTOBARBITAL SODIUM ANESTHESIA UPON THE CARDIAC OUTPUT OF THE DOG. Floyd Davis, Clinton B. Nash, and Robert A. Woodbury, *University of Tennessee Medical School, Memphis.*

Though these agents are widely used for general anesthesia their influence upon the cardiac output has been studied only inadequately during the last few years. The influence of Thiopental Sodium and Pentobarbital Sodium each were studied in 10 male dogs previously fasted and trained to lie quietly in a supine position. Cardiac output determinations were accomplished by the Pressure-Pulse Contour Method of Hamilton and Remington. Heart rate was obtained by means of the electrocardiograph. The heart rate, mean blood pressure, and cardiac output were obtained. The animal was then anesthetized and maintained in anesthesia for periods varying from four to seven hours.

Both barbiturates produced a progressive decrease in the cardiac output reaching a minimum after two hours of anesthesia and these values continued to remain significantly low. There was no significant change in blood pressure even though the cardiac index had been reduced on the average by 35 to 40 per cent of the control values.

THE ROLE OF HORMONAL AND DIETARY FACTORS IN GROWTH AND RESTORATION OF ENZYMES OF LIVER TISSUE. Samuel R. Tipton, C. W. Major, and J. L. Smothers, *University of Tennessee, Knoxville.* After the surgical removal of about two-thirds of the liver in rats, there is a rapid restoration of mass, protein, and enzyme activity. After 10-14 days restoration of lost material is almost complete. Thiouracil treatment resulted in a decrease in succinoxidase activity after four days of regeneration. Thyroxine caused a significant rise in enzyme activity both on the basis of dry weight and liver nitrogen. The rate of nitrogen restoration is probably increased and the total enzyme activity restored was significantly greater. A low protein diet led to a significant decrease in nitrogen and liver succinoxidase and cytochrome oxidase activity. During the 96 hours of rapid growth postoperatively the enzyme activity was increased, but still remained below control values from animals on a normal diet. Thyroxine increased the rate of enzyme activity even on the low protein diet.

NOTES ON THE BRANCHIOBELLIDAE OF SOUTH INDIAN CREEK, UNICOI COUNTY, TENNESSEE. Perry C. Holt and William A. Whittaker, *East Tennessee State College, Johnson City.*

South Indian Creek, a tributary of the Nolichucky, drains the Bald Mountains, a part of the northwestern slope of the Unaka Range. U. S. Highway 19W parallels the creek from source to mouth and the elevation range covered by our collections is from 1780 to 3560 feet. Collections were made at eight stations in the creek and its tributaries.

The following branchiobdellids were collected: two species of *Pterodrilus*, *P. alicornis* and an as yet undescribed species known from other localities in the general area, *Xironogiton instabilis*, *Xironodrilus appalachius*, and four or five species of the difficult genus *Cambarincola*, some or all of which may prove to be new. Of these *Xironogiton instabilis* and *Xironodrilus appalachius* are confined to the highest elevation, Sam's Creek, just below the crest of the mountains and at least one of the species of *Cambarincola* is confined to approximately the upper half of the elevation range. It would seem that there are ecological factors within a stream system that keep at least certain species of branchiobdellids in isolation, a conclusion contrary to Goodnight's previous one. The presence of eight or nine species of branchiobdellids in the same location at the same time, however, poses additional problems in reference to the factors that prevent competition between such sympatric forms. It is suggested that they are not really

sympatric, in some cases at least, but that given species are confined to specific locations of their crayfish hosts. Further work is planned, and a taxonomic report on the branchiobdellids is being prepared for early publication.

SOME NOTES ON THE ACTIVITIES OF THE SPOTTED GARDEN SLUG. Mary J. Brown, *Bethel College, McKenzie*. These experiments were performed on 110 slugs, which were collected in an alley in McKenzie, Tennessee, into which opened a number of grocery, feed, fish and poultry stores.

The slugs were divided into groups from 2-20 for experimentation and were kept in gallon glass jars covered with screen.

Experiments were made to determine their speed, reaction to light, several chemicals, ability to regenerate their tentacles, and feeding experiments, including both plant and animal food. The plant food consisted of leaves from many garden vegetables, grass, mole bean and trees. The animal food consisted of raw meat and boiled egg.

The results showed their average speed was 7.93 inches per minute; they were negative to light and all the chemicals used; they were able to regenerate their tentacles; and, they were very voracious, eating most of the foliage leaves given them but they did not eat the animal food.

A SURVEY OF THE DROSOPHILIDAE OF UNAKA MOUNTAIN, UNICOI COUNTY, TENNESSEE. Richard Stevenson, *East Tennessee State College, Johnson City*. Collections of species of the family Drosophilidae were made during the summers of 1950, 1951, 1952, and 1954, on Unaka Mountain in Unicoi County, Tennessee, and Mitchell County, North Carolina. During this period, 33,676 flies of seven genera, *Drosophila*, *Scaptomyza*, *Amiota*, *Rhinoleucophenga*, *Leucophenga*, *Chymomyza*, and *Mycodrosophila*, were collected. Of this number only 21 specimens were members of genera other than *Drosophila*. The species of *Drosophila* identified were *busckii*, *duncani*, *melanogaster-simulans affinis*, *algonquin*, *athabasca*, *transversa*, *putrida*, *testacea*, *tripunctata*, *hydei*, *robusta*, *colorata*, *melanica*, *nigromelanica*, *micromelanica*, *immigrans*, *sigmoidea*, and *magnafumosa*.

LARVAL DEVELOPMENT OF *GYRINOPHILUS WARNERI*. Ralph M. Sinclair, *Martha Vaught School, Nashville*. *Gyrinophilus warneri* was described in 1951 from three recently transformed specimens. Since that time no adults have been found. However, large series of larvae of the various age groups have been collected from the type locality.

Length of the larval period is around 16 months. Eggs presumably are laid in February. The young larvae are light brown and remain the same color until they approach transformation. The color of these mature larvae is orange-brown. Three recently transformed specimens were 92 mm., 78 mm., and 89 mm. in total length. The most striking thing about the larvae is the dorsal sensory pits on the head. These pits are concentrated in three general areas on each side of the head. There are two rows on each side of the body forming a lateral line though these are not nearly so pronounced as the former. These same pits have been noticed on other gyirinophilid larvae such as *palleacus* and *dummi*.

REPORT OF THE FAUNA COMMITTEE OF THE TENNESSEE ACADEMY OF SCIENCE. A. C. Cole, Chairman.

The following projects, which have not heretofore been reported by the committee, are in progress on Tennessee fauna:

Taxonomic studies of Tennessee helminths. A. W. Jones and H. Giordia, The University of Tennessee, Knoxville.

Radiation studies on the tapeworm, *Taenia pisiformis*, a parasite of dogs and rabbits, A. W. Jones and H. Giordia, The University of Tennessee, Knoxville. These studies are being conducted under an Atomic Energy Commission contract, and the Oak Ridge Experiment Station is collaborating.

Studies on the crustacean plankton of Wood's Reservoir, Tullahoma, Tenn. H. C. Yeatman, The University of the South, Sewanee.

Taxonomic studies on the Branchiobdellidae of Tennessee. P. C. Holt, East Tennessee State College, Johnson City.

Bird mortality during migration. J. C. Howell and J. T. Tanner, University of Tennessee, Knoxville.

Taxonomic and distributional studies of the ant genus *Solenopsis*. W. J. Cloyd, University of Tennessee, Knoxville.

Acorn-inhabiting ants of East Tennessee. A. C. Cole, University of Tennessee, Knoxville.

Biology and taxonomy of Tennessee Geotrupinae. H. F. Howden, University of Tennessee, Knoxville.

Biology and taxonomy of the North American beetles in the genus *Onthophagus*. H. F. Howden, University of Tennessee, Knoxville.

Tennessee Nitidulidae with special reference to their biology. R. Quillan and H. F. Howden, University of Tennessee, Knoxville.

New Tennessee Pselaphidae. Orland Park, Northwestern University, Chicago.

The following projects, heretofore reported, have been continued:

A roadside census of birds of Knox County, Tennessee. J. C. Howell, University of Tennessee, Knoxville.

Effects of temperature on nesting activities of juncos. J. T. Tanner, University of Tennessee, Knoxville.

Ants of the Chilhowee Mountains. A. C. Cole, University of Tennessee, Knoxville.

The ant genus *Smithistruma* in East Tennessee. W. J. Cloyd, University of Tennessee, Knoxville.

The following projects have been completed, with publication:

Behrend, Fred W. 1953. Hawk Migration—Fall 1953. *The Migrant*, 24 (4):69-73.

Coffey, Ben B., Jr. 1954. Smith's Longspur in the Mid-South. *The Migrant*, 25 (3):46-48.

Conaway, Clinton H. 1954. The Reproductive Cycle of Rice Rats (*Oryzomys palustris palustris*) in Captivity. *J. Mammalogy*, 35 (2):263-266.

Ganier, Albert F. 1954. A New Race of the Yellow-bellied Sapsucker. *The Migrant*, 25 (3):37-41.

Ganier, Albert F. 1954. Spring Water Birds at Nashville—1954. *The Migrant* 25 (2):21-23.

Goodpasture, Katherine A. 1954. Warblers Breeding at Basin Springs, Tennessee. *The Migrant*, 25 (3):42-45.

Howell, Joseph C. 1954. Population and Home Ranges of Small Mammals on an Overgrown Field. *J. Mammalogy*, 35 (2):177-186.

Howell, Joseph C., Amelia R. Laskey, and James T. Tanner. 1954. Bird Mortality at Airport Ceilometers. *The Wilson Bulletin*, 66 (3):207-215.

Laskey, Amelia R. 1954. Blue Jays Feed Tent Caterpillar Pupae to Nestlings. *The Wilson Bulletin*, 66 (1):65-66.

Pickering, Charles F. 1953. Hummingbirds. *The Migrant*, 24 (4):67-68.

Schultz, Vincent. 1954. The Effects of a Severe Snow and Ice Storm on Game Populations in Tennessee. *J. Tenn. Acad. Sci.*, 29 (4):305-314.

1954. Status of the Bobcat in Tennessee. *J. Tenn. Acad. Sci.*, 29 (1):66-72.

1954. Status of the Beaver and Otter in Tennessee. *J. Tenn. Acad. Sci.*, 29 (1):73-81.

1954. Status of the Spotted Skunk, Common Skunk, and Woodchuck in Tennessee. *J. Tenn. Acad. Sci.*, 29 (4):305-314.

Stupka, Arthur. 1954. Evening Grosbeaks in the Great Smoky Mountains and Vicinity. *The Migrant*, 25 (1):7-9.

T.O.S. Members. 1953. The 1953 Christmas Season Bird Counts. *The Migrant*, 24 (4):76-83.

T.O.S. Members. 1954. The 1954 Spring Field Days. *The Migrant*, 25 (2):26-33.

Tanner, James T. 1954. Bird Names. *The Migrant*, 25 (1):3-6.



## THE COLLEGIATE SECTION

SOME NOTES ON THE COLLECTION AND PRESERVATION OF LEPIDOPTERA. ETHYL ACETATE AS A KILLING AGENT. George Drewry, George Peabody College, Nashville.

MIXED MESOPHYTIC SEGREGATES OF A HIGH CONE FOREST IN THE SMOKY MOUNTAINS AS SHOWN BY THE USE OF A PLOTLESS SAMPLE METHOD. Edward E. Clebsch, University of Tennessee, Knoxville.

THE PREPARATION AND ANALYSIS OF 4-P-FLUOROSTYRYLQUINOLINE METHIODIDE. Joan Wilson, Carson-Newman College, Jefferson City.

CLOSE-UP PHOTOGRAPHY. James Mayberry, Austin Peay College.

OBSERVATIONS ON VARIANTS IN WILD STRAINS OF *DROSOPHILA*. Belmont College.

New officers are: President, A. K. Broyles of East Tennessee State College; Vice President, George Drewry of George Peabody College. Other officers are to be appointed by the President.

## JUNIOR ACADEMY PROGRAM

SELECTING YOUR SCIENCE. M. S. McCay, President, *Tennessee Academy of Science*.

DESIGN AND CONSTRUCTION OF A REFRACTING TELESCOPE. Chick Schwartz, West End High School, Nashville.

HUMAN TORSO AS TEACHING DEVICE. J. Nolan and W. H. Waugh, Montgomery Bell Academy, Nashville.

BEAUTY IS EVERYWHERE. Diane Clifton, Goodlettsville High School, Goodlettsville.

ELECTROCUTION OF INSECTS. Earl Patterson, Young High School, Knoxville.

SAPROLEGNALES OF KNOX COUNTY. Tommye Armstrong, Young High School, Knoxville.

PROPAGATION OF PLANTS BY GRAFTING AND AIR LAYERING. Jack Palmer, Central High School, Fountain City.

RELIEF MAP OF LUNA. Rollin A. Lasseter, Montgomery Bell Academy, Nashville.

STUDY OF BLIND SPOTS AND COLOR PERCEPTION. Fred Roberts and Chesley Lyon, Young High School, Knoxville.

DEMONSTRATION OF AMATEUR RADIO. Willard Sitton and Dee Stone, Young High School, Knoxville.

PORTABLE X-RAY APPARATUS. Ed Riley Pollard, Oak Ridge High School, Oak Ridge.

MODEL TO DEMONSTRATE NEWTON'S LAW OF ACCELERATION. Sam Porter, Montgomery Bell Academy, Nashville.

STUDIES IN THE LIFE CYCLE OF THE BLACK SWALLOWTAIL BUTTERFLY, *Papilio Polyxenes*. Reba Beasley, West End High School, Nashville.

FOUNTAIN PEN RADIO. W. A. Coleman, Jr., Montgomery Bell Academy, Nashville.

BALLISTIC, LOGARITHMIC GRAPHS OF BULLETS FIRED AT ALL ANGLES. John Litton High School, Nashville.

BACTERIOLOGY. Victor Jefferies, Issac Litton High School, Nashville.

SIMPLE ELECTRICAL APPARATUS. Roberta Shown, Central High School, Fountain City.

STROBOSCOPE. Earl Cook, Chattanooga High School, Chattanooga.

HOME BROADCASTER. Lon Foster West and D. V. Johnson, Montgomery Bell Academy, Nashville.

SOME UNUSUAL ASPECTS OF PHOTOGRAPHY. Betty Pendergrass and Barbara Wayman, Young High School, Knoxville.

ACTIVE CONSTITUENTS OF NATURAL DRUGS. Stanley Marshall, Issac Litton High School, Nashville.

EXPLAINING TAXIDERMY. Albert J. Wheeler, Montgomery Bell Academy, Nashville.

FOSSILS. Elbert H. Coles, Goodlettsville High School, Goodlettsville.

EFFECT OF ACIDS ON GERMINATION OF SOME SEEDS. Gail Wilson and Linda Strasburger, Young High School, Knoxville.

ELEMENTARY ELECTRONIC BRAINS. Bob Larson, Oak Ridge High School, Oak Ridge.

VAN DE GRAAFF GENERATOR. Bill Epps, Warren Davis, Fletcher Harvey, Montgomery Bell Academy, Nashville.

PROPULSION. Billy McConnell, David Lipscomb High School, Nashville.

THE DETECTION OF ATOMIC PARTICLES. Stanley Von Hagen, West End High School, Nashville.

INTERNAL STRUCTURE OF A FROG. Joyce Anne Mullican, Goodlettsville High School, Goodlettsville.

LEPIDOPTERA OF TENNESSEE. Mary Anne Moores, East Nashville Senior High School, Nashville.

BLOOD TYPING. Lydia Sue Shipe, Central High School, Fountain City.

CHEMISTRY OF THE COMMON ACTIVE PRINCIPLES OF NATURAL DRUGS. John Dennison, Isaac Litton High School, Nashville.

PLANT COLORING MATTER AND CHEMICAL CLASSIFICATION. Billy Crump, Isaac Litton High School, Nashville.

SCHOOL LIGHTING. Bill McSpadden, Young High School, Knoxville.

SNAKES OF TENNESSEE. Fletcher Harvey III, Montgomery Bell Academy, Nashville.

LINEAR ACCELERATOR. Jerry Corvin, Clarksville High School, Clarksville.

BLACK LIGHT. Shirlene Rogers, Young High School, Knoxville.

TIME-DELAY BURGLAR ALARM. Jim Overall, Montgomery Bell Academy, Nashville.

MICROWAVE SPECTROSCOPY. Ted Scott, West End High School, Nashville.

WIND TUNNEL. Dick Culver, Oak Ridge High School, Oak Ridge.

MINERALS OF MIDDLE TENNESSEE. Carl Seyfert, Jr., Hillsboro High School, Nashville.

DECLINATION OF TERRESTRIAL MAGNETISM. Hampton Roy, Oak Ridge High School, Oak Ridge.

GEOTROPISM. Douglas Saunders, Oak Ridge High School, Oak Ridge.

BROADCAST RECEIVER WITH DIODE DETECTOR AND TRANSISTOR AMPLIFIER. Robert Neidert, Father Ryan High School, Nashville.

A VACUUM CHROMATOGRAPH COLUMN. Sam D. Leach, Father Ryan High School, Nashville.

The judges awarded first place to Miss Tommye Armstrong, Young High School, Knoxville and Mr. Billy Crump, Isaac Litton High School, Nashville.

Honorable Mention was given to Chick Schwartz, West End High School, Nashville, to Rollin A. Lasseter, Montgomery Bell Academy, Nashville, to Betty Pendergrass and Barbara Wyman, Young High School, Knoxville, to Bob Larson, Oak Ridge High School, Oak Ridge, to Jerry Corvin, Clarksville High School, Clarksville, and to Dick Culver, Oak Ridge High School, Oak Ridge.

#### NEW MEMBERS, TENNESSEE ACADEMY OF SCIENCE, FOR 1954

Akers, Lawrence K., 108 S. Purdue Avenue, Oak Ridge.

Alexander, Frank M., G-5 State Office Bldg., Nashville.

Archer, Allan F., Biology Dept., Union University, Jackson.

Bardwell, Dwight C., 4006 Estes Road, Nashville.

Barr, Thomas C., Jr., Dept. of Biology, Vanderbilt University, Nashville.

Beck, John R., Biology Dept., U.T. Martin Branch, Martin.



- Bennett, Thomas L., 704 Pound Bldg., Chattanooga.  
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Bigger, Theodore C., Dept. of Agronomy, Tenn. Poly. Inst., Cookeville.  
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Comar, Cyril L., ORINS Medical Division, Oak Ridge.  
DeSelm, H. R., Dept. of Biology, Middle Tennessee State College, Murfreesboro.  
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Link, Cord H., Jr., P. O. Box 152, Tullahoma.  
Litkenhaus, Edward, Vanderbilt Univ., Nashville.  
Lord, Lois Pearl, Botany Dept., U.T., Knoxville.  
Luebke, B. H., Agric. Expt. Station, U.T., Knoxville.  
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Lyle, Charlotte G., Botany Dept., U.T., Knoxville.  
McClurkin, J. I., Jr., Lambuth College, Jackson.  
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Newton, Robert R., Physics Dept., U.T., Knoxville.  
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