

PROCEEDINGS OF THE
TENNESSEE ACADEMY OF SCIENCE
FOR 1962

JAMES L. WILSON, Secretary
Belmont College, Nashville, Tennessee

MEETINGS OF THE EXECUTIVE COMMITTEE
FEBRUARY MEETING

The Executive Committee of the Tennessee Academy of Science was called to order by President W. B. Jewell at 7:45 PM on February 2, 1962 in Room 312, Joint University Library, Vanderbilt University. Members present were Henry C. Allison, Clinton L. Baker, J. Gordon Carlson, William G. Downs, Jr., Willard B. Jewell, Myron S. McCay, Albert J. Myers, Elsie Quarterman, Richard Stevenson, Helen L. Ward, and James L. Wilson.

Minutes of the November Executive Committee and Annual Business Meeting were approved unanimously.

The *Secretary* reported that new applications for membership received since the Annual Meeting total 17, with 57 members dropped. A previous report at the annual business meeting indicated that 52 members were dropped for non-payment of dues, which is now revised to 40. The people have received eight dues notices from the Treasurer since 1959. Including the above changes, the total of regular members (not including library members) now stands at 813.

The *Treasurer* presented copies of the Auditors' Report. After discussion of various aspects, the report, which is printed in the JOURNAL, was approved.

The *President* presented his list of committee assignments for 1962, including the current members of the Executive Committee and a list of the 1962 section chairmen. A few of the committee members had not acknowledged their appointments, and a complete, correct list was deferred.

The *President* reported that the National Science Foundation had informed him by telephone that no state would be allowed grants totalling more than \$30,000. The three Academy proposals were larger than this amount; budgets for the Junior Academy and Visiting Scientists Program were reduced, but that for the much smaller Collegiate Division proposal was left intact.

The *President* recommended that Dr. Ward and Dr. Baker be re-elected to serve as Editor and Director of the Reelfoot Lake Biological Station respectively for the next three years; these officers have three-year terms according to the Constitution. The President also recommended that Dr. Myers and Dr. McCay be re-elected to serve as Sponsors of the Collegiate Division and Junior Academy respectively. The above recommendations were put into motions which were passed.

The *Director of the Reelfoot Lake Biological Station*, who is also Academy Conference representative, commented on the Academy Conference meeting held at

Denver with the AAAS in December. He remarked that the information supplied by the various academies for inclusion in the Academy Directory was very scant, especially with relation to the programs and activities of the academies.

A letter dated April 14, 1961 to the President of the Academy regarding the use of the AAAS research fund was discussed. The letter contained a table summarizing the use of this fund in the past by the various academies, various suggestions regarding policy for the use and distribution of these funds, and a request for recommendations by the Academy. No formal action was taken, but the general feelings expressed (which will be forwarded to the AAAS by Dr. Jewell) were as follows:

- 1) A much larger proportion, although not all, of the available funds for grants-in-aid of research should be allocated to those states in which other funds are inadequate.
- 2) While agreeing that a major portion of the available funds should be allotted directly to students, grants to teachers also should be made, particularly high school teachers or teachers in "poor" colleges and universities; such support undoubtedly would benefit the students of such teachers. Some preference might be given to those projects most likely to benefit prospective science teachers.

The *Sponsor* reported on the *Collegiate Division* meeting held Saturday, November 25, 1961; the papers presented are contained in the printed program for the Academy. The papers adjudged best were:

Biological Sciences: "Evidence for a Spontaneous Translocation in *Mus musculus*," by Faydine Kilgo, Tusculum College.

Physical Sciences: "History and Oddities of the Number Pi," by Mose Mallette, University of Chattanooga.

The following officers were elected for the new year:

President: Dwayne Ayres, Tusculum College
Vice-President: Katherine Taylor, Tusculum College
Secretary-Treasurer: Sue Reynolds, Tenn. Poly. Inst.
Reporter: Terry Fortune, Memphis State University

A majority opinion of the Collegiate Division is that it would suit its members better if the Senior Academy annual meeting were held at a time other than Thanksgiving weekend.

A Collegiate Division meeting in the western region of the state at Lambuth College on March 10, and a similar meeting for the middle region under the direction of Professor Arthur Cook of Peabody, probably April 7, are planned. The meeting for the eastern

region, arranged by Don Jackman, a Maryville College student, will be held in mid-April.

The *Sponsor of the Junior Academy* presented and discussed the following topics concerning the Junior Academy activities:

1) Regional Science Conferences:

Martin College, Pulaski, January 20, 1962, "Topology," Dr. Billy Bryant

University of Chattanooga, January 20, 1962, "Alaska," Dr. Royal Shanks

2) At the annual TJAS Information Meeting, November 25, 1961, Dr. W. W. Grigorieff, Director of University Relations Division, ORINS, proposed and outlined two possible training programs in which ORINS could offer "off season" assistance in the manner of the "FRONTIERS OF SCIENCE" institutes arranged in 1961 by the Washington Academy of Science.

a) Extension of the annual Junior Science Honors Day, Oak Ridge, to include laboratory experiences throughout the first week of June. This opportunity will be explored by TJAS and ORINS, with assistance from the Union Carbide Nuclear Company, in 1962.

b) High School Teachers Institute, one week, January-May, 1962. This potentiality has been endorsed by the Superintendents of the Clarksville and Chattanooga Schools, and by various teachers and principals. TJAS has proposed that Dr. W. W. Wyatt, University of Tennessee, be requested to organize this special program of science teacher training.

3) Other suggestions from the TJAS Information Meeting, November 25, 1961:

a) Dr. Richard Raridon, Memphis State, suggested that "Community Programs for High School Science Teachers" might serve the purpose of the "Frontiers of Science" Institute offered by the Washington Academy. In this connection, a recent NSF statement regarding the greater value, efficiency and economy of the "in-service" institutes, as compared to the Summer Science Institutes, adds significance to Dr. Raridon's idea.

b) Mr. Conrad Bates, Chattanooga High School physics teacher, noted the training value of Junior Academy participation, and appealed for aid to students and teachers in finding and exploring effective projects.

c) Mr. James Major, Clarksville High School physics teacher and Director of the Tennessee Science Talent Search, reviewed the 17-year-old program of TSTS and its relation to the 20-year-old program of NSTS. Tennessee rates 10th among 40 participating states.

4) President Jewell advised the Junior Academy Sponsor of the necessity for reducing the proposed budget for 1962-63 from \$17,500 to \$14,200. Mr. Robert J. Bradshaw, Jr., TJAS Administrative Secretary, and the Sponsor have submitted the revised budget to NSF as recommended. This was effected by reducing the num-

ber of subject matter divisions from five to four (Botany, Chemistry-Earth Sciences, Physics-Mathematics-Astronomy, Zoology) and by imposing corresponding 20% reductions on other budgeted items.

5) At the request of the Chairman of the Committee for Junior Academies of the AAAS Academy Conference, the Sponsor of TJAS presented a paper entitled "Regional High School Science Conferences" at the 128th meeting of the Association, December 28, 1961, Denver, Colorado.

The TJAS Sponsor has been requested to serve as Chairman of the Junior Academy Committee at the 1962 meeting of AAAS in Philadelphia. It has been approved that representatives of the State Junior Academies shall be invited to participate at this meeting in an initial program of Junior Science papers. Presumably one boy and one girl from the Senior High School Division will be invited to participate.

6) A grant of \$10,500 has been provided by NSF for a proposed AAAS survey of the Junior and Collegiate Academies of Science. Although the Sponsor of TJAS, along with two other state sponsors, was asked to consider acceptance of the organization and supervision of this national survey, he has been forced to withdraw his name from this consideration list because of teaching duties. It is hoped, however, that the TJAS Sponsor may be able to assist with this valuable study in the southeastern United States in the summer of 1962.

7) Members of the Tennessee Academy of Science are cordially invited to attend the first spring meeting of TJAS at Martin, Tennessee, March 23-24. A tour of the Reelfoot Lake area is planned for the afternoon of March 23.

This Executive Committee meeting adjourned at 10:15 PM and met the next morning at 9:00 AM in the Faculty Room of the Divinity School, Vanderbilt University.

The *President* read a letter from Dr. Claude Chadwick inviting the Academy to hold its 1962 Annual Meeting at George Peabody College on Thanksgiving weekend, November 23-24. The *President* again pointed out some objection to holding the meeting on Thanksgiving weekend, but he emphasized the fact that most schools cannot hold the meeting at any other time during the fall because of the lack of rooms for meetings while classes are in session. A motion accepting this invitation was seconded and passed.

Suggestions for changes in the Distinguished Teachers Certificate were requested by the *Secretary* before re-printing.

The *Treasurer* reported that, under present conditions, the Academy Treasury could afford about \$1,200 a year assistance for running the offices of the *Editor* and *Secretary*. A motion was passed that \$50 per month be allotted for secretarial help to the *Editor* and to the *Secretary*.

Subsequent discussions of the Executive Committee were concerned with:

- 1) The compiling of a history of the Tennessee Academy with the suggestion that the possibility be explored for having this completed as a Master's degree thesis. No further action was taken.
- 2) The merits of the General Session of the annual meeting. Invited, survey-type papers from selected subject matter areas were suggested as being desirable for acquainting the entire membership of more recent advances.
- 3) The formation of a new section of the Academy for high school and elementary science and mathematics teachers as proposed by Dr. Arlo Smith. A motion for approval of such a section was passed, provided Dr. Smith obtained fifteen signatures of high school and elementary teachers who are members of the Academy.
- 4) The submission of titles and abstracts of papers for presentation at the annual meeting. The difficulties in obtaining titles and arranging purposeful programs were noted by the President and Secretary. Suggestions also were made for improving the abstract request form. No formal action was taken.
- 5) The request, at the suggestion of Dr. Downs, that the Secretary assume the responsibility for finding ways and means of obtaining better publicity throughout the state concerning Academy activities.

The meeting adjourned at 11:20 AM.

NOVEMBER MEETING

The Executive Committee of the Tennessee Academy of Science was called to order by President W. B. Jewell at 8:00 AM, November 23, 1962, in Room 101, Industrial Arts Building, George Peabody College. Members present were H. C. Allison, C. L. Baker, J. G. Carlson, W. G. Downs, Jr., W. B. Jewell, M. S. McCay, A. L. Myers, E. Quarterman, R. Stevenson, J. L. Wilson, J. L. Major (Chairman of the Science Talent Search Committee), R. Rusk (Director of the Visiting Scientist Program), and F. T. Wolf (Chairman of the Fellows Committee).

The February Executive Committee Meeting minutes were approved as corrected.

The Secretary reported that 171 applications for membership were received this year, including 2 reinstatements. There were 32 members dropped, and 6 members are deceased. The membership now stands at 946, plus 7 supporting members. Application blanks for membership were sent to each of the section chairmen with the information that 35 of the 83 persons (42%) presenting papers were not members of the Academy. On October 9, the Secretary sent letters to 15 newspapers and 17 television stations in Tennessee and to the 2 wire services. The letter contained information concerning the Academy and the forthcoming anniversary meeting along with a copy of the program. Two letters from the Academy Conference concerned (1) a request for a fiscal report of each National Science Foundation-supported program in the improvement of science and/or mathematics, and (2) a progress report on a history of the Academy and steps taken to

preserve Academy archives.

The Treasurer reported \$5,725.55 in cash on hand as of November 15, an amount of \$450 more than reported at this time last year. Details concerning expenditures and savings accounts were discussed, and the report was approved unanimously.

Dr. Jewell reported the resignation of Dr. Small as Chairman of the Membership Committee. His extremely successful chairmanship was terminated when he took a position at a state college in New York. Dr. James Ward was appointed as the new chairman of this committee. Regret was expressed because of the resignation of Dr. Helen Ward, the very able Editor of the JOURNAL since the resignation of Dr. Shaver in 1954.

Dr. Allison reported that the cover of the program was printed in gold in keeping with our Golden Anniversary. Because of a great demand for the program, an extra printing of 250 was made over the original 1,350.

The Editor's report, read by the Secretary, is as follows: "The four numbers of Volume 37 (1962) consist of 133 pages. This includes 22 research or review papers, of which eight are in Zoology, three are in Botany, two are in Bacteriology, one is in Physics, three are in Chemistry, three are in Mathematics, and two are in Geology. The reaction to the new and larger two-column format seems to be uniformly favorable. The work of editing the JOURNAL has been a very pleasant and satisfying experience, and I regret that I must relinquish the editorship due to the pressure of other duties. I want to express my appreciation to the officers of the Academy, the members of the Executive Committee, and others for their help and support in making the JOURNAL a success. I want to thank especially the Section Editors for their cooperation in the work of editing the JOURNAL." This report was approved unanimously.

The Director of the Reelfoot Lake Biological Station stated that his report would be published in the January issue of the JOURNAL.

The report of the Sponsor of the Collegiate Division which was approved, follows: "Regional meetings were held last spring at Maryville College, Maryville; George Peabody College for Teachers, Nashville; and Lambuth College, Jackson. Each of the regional organizations seems to be firmly established with the following regional sponsors: Dr. Arnold Van Pelt, Tusculum College, Eastern Region; Arthur H. Cook, George Peabody College for Teachers, Middle Region; and Dr. Tom Claypool, Memphis State University, Western Region.

"A grant in the amount of \$3,570.00 was received from the National Science Foundation in support of the Collegiate Division for the 1962-63 academic year. A planning meeting was held in Nashville, Tennessee, on September 22 in this connection with all sections of the state represented. The number of papers (29) in the program of the Collegiate Division for this annual meeting is a direct consequence of having funds from the grant to assist students in attending. This is more than three times the number of papers presented in the Collegiate Division at any previous annual meeting so far as I know. A number of schools over the

still are not represented in the program or by students attending the meetings.

"Regional meetings already are being planned for next spring, and a portion of grant funds has been set aside to be used in stimulating the attendance of these meetings.

"An application has already been submitted to the National Science Foundation for a grant in the amount of \$4,651.00 for the 1963-64 academic year. The general pattern of the proposed application is the same as that of the present grant.

"The increased amount represents the hope that interest in the program will increase. Also, it represents a more realistic estimate of the expense to the students in attending the state and regional meetings.

"Through the efforts of the state and regional student officers and sponsors for the various regions, the program seems to be going quite well. There is, however, plenty of room for participation by many other schools in the state."

The *Sponsor of the Junior Academy* presented the following summary report for 1961-62 which was approved after reading:

- 1) The Junior Academy of Science offers encouragement and experience for exceptional high school science students in the demonstration and discussion of science research projects, in a manner similar to that of adult research scientists.
- 2) TJAS meetings:
Information and Council Meetings TAS, Martin—November 24-25, 1961
Regional Science Day meetings—February 24, 1962
State Science Day Program, Martin—March 23-24, 1962
Junior Science Honors Day and Council Meeting ORNL—June 8, 1962
- 3) TJAS Organization and Attendance:
12 regions; Junior High and Senior High Divisions; 5 subject-area sections (Bot., Chem., Math.-Earth Sci., Physics-Astron., Zool.); 300 regional participants; 88 state representatives; 350 attending State Science Day programs; 1500-2000 attending Regional Science Day programs; 28 Council Members; 30 Judges and 10 Section Chairmen for State Science Day; 10-12 Local Committeemen and Assistants led by Professor Glen H. Bremer, Chairman, Lloyd King and Billy Edwards, UT-MB.
- 4) Honors Awarded:
11 Section winners; AAAS Award Winners (TJAS representative to NJAS-AAAS, Philadelphia, 1962)—Parke Sprague, Treadwell High School, Memphis, and Robert Leon Carney, Isaac Litton High School, Nashville.
- 5) Lectures:
5 Regional Science Lectures; State Science Day Lecture—*Reelfoot Lake* by Dr. Arlo I. Smith, Southwestern College at Memphis.
- 6) NSF Visitor:
Dr. James Corwin, Chemistry Department, Antioch College, Ohio. Comment: "Your Junior Academy obviously receives much donated assistance, since the program is so extensive, the budget so modest."
- 7) TJAS Budgets:
1958-59, none; 1959-60, \$8,880; 1960-61, \$10,000; 1961-62, \$12,500; 1962-63, \$13,325; 1963-64, \$15,000 (proposed).
- 8) NSF Annual Report: Outlines duties and opportunities for TJAS Council Members.
- 9) Problems:
(a) Financing travel of NJAS representatives, Philadelphia, 1962; (b) publication of winning TJAS papers; (3) publication of TEEJAY NEWS; (d) promotion of Regional Science Lectures and TJAS Chapters; (e) invitation to Albuquerque NATIONAL SCIENCE SEMINARS and NATIONAL SCIENCE EDUCATION EXPOSITION.

In response to an inquiry by Mr. Major, it was determined that expenses for stamps, printing, etc., in the Science Talent Search could not be defrayed from the Junior Academy grant.

The *Director of the Visiting Scientist Program* presented to the Executive Committee members an outline copy of a progress report and printed copies of the program announcement and roster of visiting scientists. The details of the program were discussed.

The *Chairman of the Fellows Committee* presented the names of five members selected to become Fellows of the Academy. The Executive Committee passed a recommendation that these be presented by the Chairman at the Annual Business Meeting.

The *Chairman of the Distinguished Teacher Awards Committee* read the names of those recommended to receive awards. This list of nominees was approved.

The *Chairman of the Science Talent Search Committee* presented and discussed the 1962 report of the committee. Copies of a report concerning all of the previous Tennessee Science Talent Search Winners were distributed.

Dr. Jewell reported on a petition to the Executive Committee secured by Dr. Arlo I. Smith for the formation of the new Science-Mathematics Teacher Section. It contained more than the 15 signatures required by the Constitution for the formation of a new section, and, if approved, would hold its organizational meeting at 9:30 AM Saturday, November 24, 1962. A motion was passed that the petition be granted.

The *Secretary* read a letter from Dr. Kenneth A. Fry extending an invitation from the Science and Mathematics Division of the University of Chattanooga to the Tennessee Academy of Science to hold the annual meeting of the Academy at the University during the Thanksgiving vacation of 1964. A motion was passed that the invitation be accepted if it was intended for 1963.

A resolution, presented by Dr. Quarterman needed revision. The revised resolution will be presented in the minutes of the Annual Business Meeting.

Dr. Jewell read a resolution from Dr. A. W. Jones concerning repeal of the Tennessee anti-evolution law. After considerable discussion, there was general agreement that little could be done before reapportionment of the State Legislature. A motion was passed that the resolution be tabled for the present.

Dr. Jewell read a letter from Jacob W. Shapiro, a Ph.D. candidate at Peabody, requesting financial assistance from the Academy for certain aspects of his research. A motion was passed that the request not be granted since the Academy does not have the funds.

A request was received from the Research Committee asking the Executive Committee for \$32 of Academy funds to be spent for a AAAS research grant. A motion was passed granting the request.

A letter from Dr. Glenn Gentry suggested that authors of papers published in the *JOURNAL* should be members of the Academy. The suggestion was discussed, but no action was taken except that the suggestion be delivered to the new Editor.

Dr. Albert Myers stated that personal reasons will

force him to resign as sponsor of the Collegiate Division at the end of the year.

The disposition of indirect cost funds obtained from Academy-sponsored grants was discussed. It was generally agreed that the funds would go into the Academy Treasury, but directors could draw from these funds for necessary items.

A motion was passed that Dr. James J. Friauf be elected the new Editor of the JOURNAL if permission to assume this duty is obtained from the head of his department at Vanderbilt.

The meeting adjourned at 1:30 PM.

THE SEVENTY-SECOND MEETING

The seventy-second, GOLDEN ANNIVERSARY, meeting of the Tennessee Academy of Science was held November 23-24, 1962, at George Peabody College, Nashville. Claude S. Chadwick was Chairman of the Committee on Local Arrangements and Henry C. Allison, The University of Tennessee Martin Branch, was Program Chairman.

Two hundred forty-eight persons registered for all sections of the Academy on Friday in the lobby of the Industrial Arts Building. The General Session, chaired by W. B. Jewell, was held Friday morning in Room 202, Industrial Arts Building. Five papers were presented.

Section meetings of the Senior Academy were held Friday afternoon in various rooms of the Home Economics, Industrial Arts, and Payne Buildings. The Annual Business Meeting was held at 4:40 PM Friday in Room 202, Industrial Arts Building.

The Annual Dinner, attended by 122 persons, was held in the Cumberland Room of the Peabody Student Center at 7:00 PM Friday. Dr. Seldon D. Feurt, Dean of the College of Pharmacy at the University of Tennessee, Memphis, spoke on the "Development of the Tranquilizer Gun."

An Advisory Council Meeting of the Junior Academy and an Executive Council Meeting of the Collegiate Division were held at 9:00 PM Friday.

Registration for the Collegiate Division took place on Saturday morning at 8:30 AM in Room 5 of the Payne Building. At 9:00 AM, the Collegiate Division met in four sections (Botany, Chemistry, Physics, and Zoology-Geography) for presentation of papers. An organizational meeting of the new Science-Mathematics Teacher Section was held at 9:30 AM with the presentation of six papers. An informational meeting of the Junior Academy was held at 8:00 AM with the presentation of seven papers.

Although no field trips were organized for the program, Dr. R. H. Hardie, Director of Dyer Observatory, Vanderbilt University, invited all interested persons to visit the observatory after the dinner Friday evening.

ANNUAL BUSINESS MEETING OF THE ACADEMY

The Business Meeting of the Academy was called to order in Room 202, Industrial Arts Building, at 4:30 PM by President W. B. Jewell. The minutes of the Business Meeting of 1961, published in the JOURNAL, were not read. The minutes of the Executive Committee meeting on February 2-3, 1962, were summarized by the Secretary. The minutes of the above meetings

were approved.

The *Treasurer* presented an interim report, and the *Editor's* report was read by the Secretary. Both reports were approved, and the following resolution was adopted with regard to the Editor's report:

BE IT RESOLVED that the Tennessee Academy of Science in its 1962 Annual Business Meeting highly commends Dr. Helen L. Ward for her years of service as Editor of the JOURNAL and for the fine job she has done. It is with regret that her resignation is accepted.

The *Sponsor of the Junior Academy* presented his report which was approved.

The *Secretary* reported 171 applications for membership plus an additional 11 received since the start of the meeting. A motion was passed that these 182 persons be elected members of the Academy.

The *Sponsor of the Collegiate Division* presented his report which was approved.

Dr. Jewell reported that the Executive Committee had approved a petition, supported by more than the required number of signatures, for the formation of a new Science-Mathematics Teacher Section. He announced also that the 1963 meeting of the Academy would be held at the University of Chattanooga during the Thanksgiving holidays.

The following resolution was submitted by Dr. Quarterman:

BE IT RESOLVED that, on this the 50th Anniversary of the founding of the Tennessee Academy of Science, it is appropriate that we pay especial homage to those of our membership who served the Academy during its early years and who remain members of the Academy to the present day. We wish to express our sincere appreciation of their long devotion and many valued services to the Academy, to declare our affection for them personally, and to bestow due honor upon them at this time. We wish to express extreme pleasure that some of these "elder statesmen" of the Academy could be present with us on this historic occasion, and also to express great regret that circumstances did not permit some of these honorable members to attend the celebration of the 50th Anniversary of the Academy.

BE IT FURTHER RESOLVED that the Secretary be authorized and instructed to send the greetings of the Academy and a copy of the above resolution to each of these members individually.

The above resolution was adopted, and copies were sent to Miss Jeannette M. King, Dr. George R. Mayfield, Dr. Hugh D. Miser, Mr. Roscoe Nunn, Dr. Harold A. Webb.

The following progress report in outline was presented by the *Director of the Visiting Scientist Program*:

- 1) The Director met with directors of other state academies in Washington on April 2, 1962.
- 2) Announcement of the program was made to the press on the state April 13, 1962.
- 3) The Director met with the area coordinators of last year's Short Term Institute Program and Academy officials in Nashville on May 11-12, 1962, to outline the Visiting Scientist Program.

- 4) The Director established an office for conducting the work of the program, using the facilities of the Physics Department of the University of Tennessee, and employing clerical and secretarial help.
- 5) During the summer of 1962, letters were sent to college presidents in Tennessee, teachers who were participants in the Short Term Institute Program, persons whose names were on the mailing list of the JOURNAL of the Tennessee Academy of Science, and to persons nominated by several individuals interested in the program. Those letters asked for nominations of people who might qualify as Visiting Scientists. Over 1,200 letters were sent. About 330 replies were received from professional scientists indicating further interest in our program.
- 6) Questionnaires were sent to the 330 scientists and more than 220 were returned. About 12 letters declining further participation in the program were received.
- 7) A planning conference was held in Knoxville on September 28-29, 1962 and attended by officers of the Academy, the members of the Advisory Committee to the Director of the Program, sponsor of the Junior Academy Program, and a representative of the Tennessee State Department of Education. At this meeting the Director made a detailed report of his work to date and outlined the procedures for continuing the Visiting Scientist Program. Also at this meeting, criteria were established for selection of the final Roster of Visiting Scientists.
- 8) Subsequent to this meeting the final selection was made by the Director after further correspondence with many of the scientists who had returned questionnaires.
- 9) A brochure describing the Visiting Scientist Program has been mailed to more than 2,000 science and mathematics teachers throughout the state.
- 10) The principal of each high and junior high school in Tennessee has been sent a letter of explanation, a copy of the brochure, a copy of the Roster of Visiting Scientists, a request form for inviting the Visiting Scientist, and a return envelope. This material includes all detailed instructions necessary for a school to initiate proceedings for obtaining a Visiting Scientist.
- 11) An additional announcement has been sent to the press of the state calling attention to the fact that our program is now under way.
- 12) A financial report, as of October 31, 1962, has been submitted.
- 13) We are now in a position to accept and process invitations from schools. It is our hope to schedule more than the 120 visitations provided for in the budget. A program similar to the one outlined above is being proposed for next year.

The *Academy Conference and AAAS Representative* presented the following report: "Our Academy is an affiliate of the American Association for the Advancement of Science and in good standing. I attended, as your representative, both the Council meetings of this association and the Academy Conference last December in Denver, Colo.

"There are 247 affiliates of which 42 are academies of science. The Association gained 12,000 new members last year with a present high of 70,000. Special attempts are being made to increase the lay membership. The Association's policy and present program emphasizes the 'further work of scientists, to foster co-operation among scientists, and the advancement of human welfare and public understanding of science.' There is a possibility of organizing a southeastern division and another in Porto Rico. Their annual budget is now close to \$2,000,000 and they are able to add about \$80,000 a year to their reserve. I urge all of you to join if you are not already a member.

"The Academy Conference received a National Science Foundation grant of \$10,000 for a national sur-

vey of the status of the junior academy movement. Considerable committee activity and further meeting in Memphis in February resulted in the appointment of Dr. J. B. Hopperton, of New Mexico, as director of the project. Our own M. S. McCay gave a very excellent report to the session of Junior Academies, sponsored by the Academy Conference, on 'The Nature and Purpose of Regional Science Meetings.'

"The History of Science Committee made little progress during the year. Twenty-eight academies replied to an inquiry. Twenty-one have compiled histories; the Committee recommends that each Academy take proper steps to safeguard their archives. All academies replying except three have their records stored with a permanent office or organization. These three are Hawaii, Kansas and Tennessee who state that records are 'kept by the Secretary.'

"The AAAS asked each Academy for their opinion on whether the program of their awarding grant funds to Academies should be continued (no Academy gets less than \$100 per year; some more). Twelve Academies replied (Tenn. was one) and all favored continuation of the grants on the present basis. Of the other 35, perhaps they do not favor a continuation. No change will be made for the 1962 grants.

"Last year each Academy was requested to submit a brief summary of the activities for 1961. A few replied. From these replies I glean the following:

"Alabama has created their tenth section; the Section for Engineering. Their annual dues were raised from \$3.00 to \$5.00.

"Activities of the Ohio Academy involve eleven mailings to the membership during the year.

"Pennsylvania sponsored a Science Writing Conference, supported by gifts from industry, to provide updated science materials for kindergarten through the twelfth grade. Their completed publications are now in use in 200 schools in Pennsylvania, New York, Ohio and the Phillipines.

"In Hawaii, a series of lectures was sponsored, as were teacher's science seminars.

"Academy of Southern California has nine meetings per year, seven science subject-matter sessions each year, a Junior Academy meeting and the Annual Meeting.

"New Mexico Academy has produced science films for circulation among the high schools as part of their visiting scientist program.

"South Dakota received three National Science Foundation grants: a Visiting Scientists Program, a Junior Academy Program of Conference, and a Traveling Science Kit Program.

"Montana Academy, reading the handwriting on the wall, incorporated as a non-profit organization. They are governed by a Board of Directors with appointed administrative officers.

"More than forty Academies received one or more NSF grants for a total of close to one-half million dollars. Twenty-four have grants for Visiting Scientists Programs and NSF hopes that all academies will sponsor such a program."

The *Chairman of the Science Talent Search Com-*

mittee presented the following report: "Each of the twenty-seven winners in the seventeenth Tennessee Science Talent Search was presented a certificate of award and a T.S.T.S. gold-filled pin.

"A program to honor them and state winners in the Tennessee Junior Academy of Science was arranged at Oak Ridge. This was the third year such a program was offered at the Oak Ridge Nuclear Laboratories. A full day's study of the laboratories and a banquet meeting that night marked June 7 as a day to be remembered by the members of this honors group and their sponsoring teachers.

"The composite data sheet was sent to more than fifty institutions of higher learning. Many letters were written at the request of the members of the honors group or inquiring institutions. An article was published in the Academy JOURNAL and two articles appeared in the *Tennessee Teacher*. These articles gave the results of the seventeenth Tennessee Science Talent Search and the follow-up on winners in the previous sixteen searches. Fuller reports were mimeographed for distribution to interested parties. Fifty copies were sent to Science Service, Washington, D.C. for distribution to all state chairmen of Science Talent Search.

"James B. Delano, Manager, Propulsion Branch, Propulsion Wind Tunnel Facility, Arnold Center, was appointed by the President of the Academy to serve on the Science Talent Search Committee. He has written and distributed articles to the science and mathematics teachers in Tennessee's senior and junior high schools. He has extended to these teachers an invitation to become members of the academy and participate in its program as well as that of the Junior Academy of Science.

"Letters have recently been written to winners in the last ten talent searches. Information gathered from responses to these letters will be used in a 1963 report to be released next spring."

Dr. Jewell announced a communication from Dr. Keim stating that ORNL will be happy to continue its support of the Science Talent Search.

The *Chairman of the Membership Committee* reported on the continued increase of members at a steady rate over the last five years: As of January, 1958—592; 1959—653; 1960—708; 1961—815; 1962—817; November, 1962—954.

The *Chairman of the Fellows Committee* submitted the following names of members of the Academy, recommended by the Executive Committee, for election as Fellows:

- Dr. Frank H. Barclay, Biology, East Tenn. State College, Johnson City.
- Dr. Edgar D. Eaves, Mathematics, University of Tenn., Knoxville.
- Dr. James J. Friauf, Zoology, Vanderbilt University, Nashville.
- Dr. Gustav H. Lundberg, Mathematics, Vanderbilt University, Nashville.
- Dr. Richard Stevenson, Biology, East Tenn. State College, Johnson City.

A motion passed to approve them as Fellows.

The following names of teachers, whose nominations

were approved by the Executive Committee, were read and recommended to receive Distinguished Teacher Awards:

- Mrs. Jo W. Clarke, Cohn High School, Nashville, Biology.
- Mr. James Davis, Dobyns-Bennett High School, Kingsport, Chemistry.
- Mrs. Evelyn Dooley, Central High School, Columbia, Mathematics.
- Mr. Doyle Gaines, Macon County High School, Lafayette, Biology.
- Mrs. Olivyn Hardison, Central High School, Columbia, Biology.
- Mr. Frank H. Maples, Jr., Tennessee High School, Bristol, Chemistry.
- Mrs. Blanche C. Standefer, Bledsoe County High School, Pikeville, Biol.-Chem.
- Mrs. Mabel N. White, Greeneville High School, Greeneville, Chemistry.

A motion passed to approve them for Distinguished Teacher Awards.

The *Chairman of the Necrology Committee* made note of the passing of Dr. Edward C. Blom, Mr. Frank M. Robbins, Dr. Judson H. Robertson, Dr. Royal E. Shanks, Dr. Paris B. Stockdale, and Mr. Robert S. Walker. A motion was passed to have the above names entered on the minutes as an expression of the sense of loss to the Academy of these loyal members.

The *Chairman of the Research Committee* presented the following report:

"During the past year the Research Committee received four applications for support totaling \$453 and made four awards totaling \$453. The \$32 excess of expenditures over income from the AAAS was a contribution from the Academy. Awards were made to the following: Malcolm Gordon, a student at White Station High School, Memphis, \$70, to undertake the 'Analysis of the UV Spectra of Organic Isomers'; William D. Lasater, a student at Belmont College Nashville, \$93, to study 'Improvements of Methods and Techniques in Preparation and Preservation of Zoological Specimens'; Ray Hefferlin, a professor of physics at the Southern Missionary College, \$150, to perform 'An Analysis of Known Atomic Oscillator Strengths in the Hope of Finding Significant Trends'; William Ellis, a graduate student at the University of Tennessee, \$140, to collect specimens with a view to a 'Revision of the Red Maple Section of *Acer* (Aceraceae).'

"The Committee received three inquiries after the funds had been exhausted. It would, no doubt, be advantageous if more requests were submitted; however, the Committee felt that the funds were awarded for very worthy endeavors.

"The Committee has prepared a uniform application blank which is now being used. We have written a few letters soliciting applications and have asked the Editor of the JOURNAL to insert notices in that periodical. Also we have asked each recipient of a grant to give us a brief report of progress at the end of the grant year.

The *Chairman of the Resolutions Committee* submitted a resolution (printed separately following the minutes of this meeting). A motion to approve

resolution and to send copies to Dr. Felix Robb and Dr. Claude Chadwick was passed.

The Chairman of the Nominating Committee proposed the following slate of officers:

President: Henry C. Allison, The University of Tennessee Martin Branch, Martin.

President-Elect: James W. Ward, Vanderbilt School of Medicine, Nashville.

Secretary: James L. Wilson, Belmont College, Nashville.

Treasurer: William G. Downs, Jr., Tennessee Polytechnic Institute, Cookeville.

Since there were no nominations from the floor, with the unanimous consent of the members present, the Secretary was instructed to cast one ballot representing the unanimous vote of the members present.

The following resolution was presented from the floor by Dr. Arthur W. Jones:

WHEREAS, at the December, 1960 meeting of the Tennessee Academy of Science, a resolution was adopted by the Academy urging the Legislators of the General Assembly to repeal the Tennessee law which prohibits the teaching of Biological Evolution in the tax-supported schools and colleges, for reasons set forth in that resolution as follows:

This law is, in the opinion of leading scientists and educators, a detriment to scientific training of Tennessee teachers and students, and it is a deterrent in attracting scientists and science teachers to the State. This law is, by its very nature, contrary to democratic practices and beliefs in that it is a law directed toward control of the thoughts of men. The existence of this law is an embarrassment to the citizens of Tennessee and to the United States, and, in fact, to the free world inasmuch as it is aimed at suppression of free inquiry and has been used in propaganda against us.

AND WHEREAS, the 1960-61 General Assembly failed to repeal the aforesaid law,

BE IT RESOLVED that as this Academy did 37 years ago, when by appearing as *amicus curiae* in the Scopes case, it made known its concern for freedom of thought and inquiry, it again states its opposition to the anti-evolution law, and publicly invites other groups and individuals to join in urging repeal of this law.

A motion to approve the above resolution was passed by a majority vote.

A motion then was made that the Executive Committee of the Academy meet with the incoming Governor of Tennessee with regard to the above resolution. The motion failed to come to a vote because of the lack of a second.

The Annual Business Meeting adjourned at 5:45 PM.

REPORT OF THE RESOLUTIONS COMMITTEE OF THE TENNESSEE ACADEMY OF SCIENCE 1962

WHEREAS, the Tennessee Academy of Science, including the Collegiate Division and the Junior Academy of Science, are enjoying a most pleasant, profitable, and well-organized series of meetings at George Peabody College for Teachers, and

WHEREAS, the success of these meetings has resulted from the efforts of the officers and sponsors of these organizations, the chairmen of the respective sections, the members of the Committee on Local Arrangements, Claude S. Chadwick, Chairman, J. Houston Banks, Arthur H. Cook, H. Craig Sipe, Henry T. Waddell, and the Tri Beta Club of George Peabody College, from the recognition given the meetings by the local press, television and radio stations, and from the generous hospitality of our host institution,

BE IT RESOLVED, therefore, that the Tennessee Academy of Science express its gratitude and sincere appreciation to these and all others who have contributed to the success of these meetings, and

BE IT FURTHER RESOLVED that these resolutions be included in the minutes of the Tennessee Academy of Science and published as a part of the Proceedings of this meeting and that copies be sent to Dr. Felix C. Robb, President of George Peabody College for Teachers, and to Dr. Chadwick, Chairman of the Committee on Local Arrangements.

Respectfully submitted by the Resolutions Committee:

Nelson Fuson

Mark M. Jones

G. H. Lundberg, Chairman

SEVENTEENTH ANNUAL TENNESSEE SCIENCE TALENT SEARCH—1962
Sponsored and Financed by the Tennessee Academy of Science
Director: Mr. James L. Major, Chairman, STS Committee; Physics Teacher, Clarksville High School, Clarksville, Tenn.

National Honors Group

- Carney, Robert Leon, Isaac Litton H.S., Nashville, "Synthesis of Pseudotropines."
- Pigg, Jay Cee, Catholic H.S., Knoxville, "Electroluminescence."
- Sapp, Edwin Robert, Central H.S., Columbia, "Color in Simple Copper Amine Complexes."
- Shoemaker, Rheada M., Sacred Heart H.S., Memphis, "Effects of Daily Ingestion of Alcohol on Rats."
- Stults, Carol Lorna, Hillsboro H.S., Nashville, "Kinetics of Photochemical Reduction of Benzophenone in Isopropyl Alcohol."

Winners of the Tennessee Science Talent Search (In addition to those listed in the National Honors Group)

- Bell, Robert K., Clarksville H.S., Clarksville, "Comparison of River Waters Before and After Pollution."
- Burroughs, Judy Faye, Carter H.S., Strawberry Plains, "Bone Marrow Transplantation in Mice."
- Busler, William J., Christian Brothers H.S., Memphis, "An Inexpensive Gas Chromatograph."
- Clayton, Roderick D., Oak Ridge H.S., Oak Ridge, "Respiration Rate as Measured by Reduction of Methylene Blue."
- Cobble, Clark Robert, Hillsboro H.S., Nashville, "Effects of Gibberellic Acid on Molds."
- Galbreath, John C., Hillsboro H.S., Nashville, "Detecting Hydrogen Nuclei with a Magnetic Resonance Spectrometer."
- Gordon, Malcolm A., White Station H.S., Memphis, "Ultra-violet Spectra of Isomers."
- Hamner, G. Henry, Clarksville H.S., Clarksville, "Mathematical Puzzles."
- Hand, Birney LaRoy, White Station H.S., Memphis, "Biological Factors of Weightlessness."
- Harold, David W., Central H.S., Memphis, "Cryogenics."
- Hutcheson, Robert N., Hillsboro H.S., Nashville, "Effects of

Gibberellin on Plant Growth."

- Jamison, James Jay, Bearden H.S., Knoxville, "Capillary Action."
 Jamison, Michael Ray, Tennessee H.S., Bristol, "Optical Illustrations."
 Leinart, Glen T., Central H.S., Knoxville, "Buried Treasure Problem."
 Leydordf, William F., Notre Dame H.S., Chattanooga, "Young's Modulus."
 Mayhew, Larry D., Cohn H.S., Nashville, "A Development of Prime Numbers."
 Morgan, Charles G., Central H.S., Knoxville, "Rationality of Square Roots."
 Pittman, Roland N., Memphis Technical H.S., Memphis, "Nuclear Magnetic Resonance."
 Rasnick, William H., Tennessee H.S., Bristol, "Radioactivity."
 Riddick, James R., Oakhaven H.S., Memphis, "Radioactivity."
 Sprague, Parke D., Treadwell H.S., Memphis, "Molecular Weight of Cellulose Propionate."
 Waters, Joe W., Clarksville H.S., Clarksville, "Study of the Electron."

GENERAL SESSION

Friday, November 23, 10:00 AM
 Room 202, Industrial Arts Building
 W. B. Jewell, Chairman

A Cooperative Program in Graduate Education between ORNL and the Southern Universities. H. B. Willard, Oak Ridge National Laboratory.

Since its inception, ORNL has been concerned with science and engineering education. The Laboratory has encouraged professors and students in neighboring colleges and universities to use their magnificent and often unique facilities. In particular, a graduate fellowship program has been in effect the past 14 years; selected students sponsored by the Oak Ridge Institute of Nuclear Studies come to the Laboratory to do thesis research under the joint direction of ORNL staff members and university advisors. Under this program, some 26 different universities have granted an average of 5 Ph.D. and 1 M.S. degrees per year, principally in the fields of biology, chemistry, and physics. In the present stage of the scientific manpower shortage it was decided to expand and improve this program. Other means of involving the ORNL staff and facilities more directly in graduate education also have been explored.

Recent Improvements in the Seyfert 24-Inch Telescope. R. H. Hardie, Dyer Observatory, Vanderbilt University.

The 24-inch primary mirror of the Seyfert Telescope has been remounted in a flotation-type support system which results in its being least constrained while accurately located in a fixed position. Current studies indicate a finer image form than was formerly achievable.

A Photographic Approach to Occultation Timing. C. D. Geilker, Dyer Observatory, Vanderbilt University.

At the September 10 occultation of Saturn by the moon, an experiment was made to determine the time of the occultation photographically, using an instrument of six inch aperture and equipment such as would be available to the average amateur. The method is accurate to a few seconds and permits the measurements and final determination to be made under the relatively non-stressful conditions of one's study.

Panel Discussion—Activities Within Certain State Agencies of Interest to the Tennessee Academy of

Science. Harold N. Mullican, Billy G. Isom, Ralph M. Sinclair, Tennessee Stream Pollution Control Board, Tennessee Department of Public Health. Glenn Gentry and C. E. Ruhr, Tennessee Game and Fish Commission. H. L. Bruer, Department of Agriculture, Division of Plant Industry.

An Action Program for Superior and Talented Students. Jacob W. Shapiro, George Peabody College.

SECTION MEETINGS

Friday, November 23, 1:30 PM

BOTANY SECTION

Room 3, Home Economics Building
 Robert B. Channell, Chairman

Cytological Studies in the Genus Uniola (Gramineae). Harris O. Yates, Vanderbilt University.

Seven species of the genus *Uniola* were studied cytologically to determine the meiotic chromosome number and behavior at diakinesis. Meiotic material of *U. latifolia* was obtained from the Interior Low Plateau, that of *U. virgata* from Jamaica, and that of all other species from Coastal Plain populations.

Twelve bivalents were formed in *Uniola laxa*, *U. sessiliflora*, *U. ornithorhyncha* and *U. nitida*. Twenty-four bivalents were formed in *U. latifolia* and twenty in *U. paniculata* and *U. virgata*.

Together with evidence from other sources, the results of this study support the hypothesis that *Uniola* is composed of discordant taxonomic elements representing two or three different genera.

A Comparison of Some Physical, Chemical, and Biotic Properties of Quinland Lake and its Effluent. David W. Eldridge, Tennessee Polytechnic Institute.

A series of limnological investigation were performed on a small lake located ten miles from Cookeville, Tennessee. These studies were concerned with a comparison between the lake and its effluent with regard to dissolved oxygen, pH, thermal factors, total soluble salts, and plankton populations.

Seed Reproduction and Seedlings in The Genus Dentaria (Cruciferae) in Eastern North America. Neil A. Harriman, Vanderbilt University.

The five species of *Dentaria* in eastern North America are high polyploid, rhizomatous perennials which previously have been interpreted as an agamic complex. Seed reproduction is here reported for *D. laciniata*, *D. heterophylla*, *D. multifida*, and *D. diphylla* for the first time in Tennessee populations, where these species sometimes occur sympatrically. Seed reproduction in *D. laciniata* from southern Ohio was discovered by E. Lucy Braun in 1957; the present report is thought to be the first for seed reproduction in the last three species. The cotyledons of *D. heterophylla* and *D. multifida* are strictly hypogeous—the first photosynthetic organ is true leaf—while in *D. diphylla* one cotyledon is hypogeous and one is epigeous, as is also true of *D. laciniata*. Although the evidence is indirect, the seeds of all four species are believed to have been produced sexually. In view of the differences in seedling development, this information will contribute to an understanding of the evolution of these species.

The Cytology of Two Species of Schoenolirion (Liliaceae). Harry L. Sherman, Vanderbilt University.

Schoenolirion croceum and *S. texanum* are morphologically similar species whose ranges overlap in the Cumberland Plateau region of Alabama and in the wet pinelands and prairies of eastern Texas. Populations of both species are highly localized, and the Alabama populations are widely separated from those in Texas by the Mississippi Embayment region from which neither species has been reported.

Other than possible statistical differences, flower color seems to represent the only easily-recognized character by which the two species may be distinguished. However, populations of *S. croceum* from middle Tennessee, northern Alabama, and the granitic region of Georgia have haploid chromosome numbers of 15 and 16, while *S. texanum* from both sides of the Embayment region has a haploid number of 12.

It seems likely that karyotype studies may provide clues concerning the differentiation and migration of these cytological races, and they should help to decipher evolutionary relationships within the genus as a whole.

The Proportion of Antagonists to Non-antagonists for Escherichia coli and Staphylococcus aureus in Samples of Local Soils. Nathanael A. Harrison, Edward E. Noble, and Arlon H. Way, Tennessee Polytechnic Institute.

Soils were randomly sampled from various localities in and around Cookeville, Tennessee. These samples were screened for antibiotic producing bacteria active against *Escherichia coli* and *Staphylococcus aureus*. Their proportion to non-antibiotic producing bacteria was determined.

Forty-five samples were screened against each of the two bacteria. It was found that approximately four-tenths per cent of the colonies were antagonistic for *Escherichia coli* and approximately one per cent showed antibiotic activity against *Staphylococcus aureus*.

Shoot Apex Structure in Agave lechugilla Torrey. James M. Moore, University of Tennessee Martin Branch.

The shoot apex is only a small cluster of cells in the embryo. In a seedling and young adult, it is usually asymmetrical, appearing cone-like when viewed in the plane of the cotyledonary slit but dome-like when viewed in a plane at right angles to the cotyledonary slit. In older plants, the apex is almost symmetrical and appears in median longitudinal section as a broad dome.

The five zones characteristic of the shoot apex are established at least by the time the first leaf has reached a length of one-fourth inch. They include (1) a 1-layered tunica, (2) a corpus, (3) a flank meristem, (4) a rib meristem and (5) a zone below the flank meristem and lateral to the rib meristem. As the apex increases in size, periclinal divisions in the outer corpus become fewer and result in the establishment of additional tunica layers. In the adult shoot apex these appear to vary from 4 to 5.

Notes on the Golden Aster, Chrysopsis spp. P. L. Hollister, Tennessee Polytechnic Institute.

Work on the golden asters of the eastern Highland

Rim of Tennessee has been reported each year since 1959. Observations have been extended to cover much of the eastern half of the state. Recently, this survey has been extended into four adjacent states.

Most areas under observation, even to a limited extent during the three-year period, show a distinct increase in population of one species. The same species has been collected some distance over the state line in Kentucky. In three other adjoining states, golden asters also have been collected, but these have not been the same as the populous species in Putnam County.

One species has been propagated for three seasons without the germination of any seed. Viability and germination tests have been done under laboratory conditions. Also, similar tests have been carried through one season under natural conditions with, and without, the usual competitors.

Heterostyly in Oxalis Priceae (Oxalidaceae). David L. Mulcahy, Vanderbilt University.

Oxalis Priceae Small, abundant in the cedar glades of Tennessee and elsewhere, is tristylous. However, morphological differences sometimes associated with tristily, such as variation in stigmatic papillae and pollen size, are not evident. Individual plants exhibit rapid and extensive clonal growth, a factor which may influence the breeding behavior of the species. Although morphologically tristylous, the species is not functionally so. Thus, of the eighteen possible pollinations between and within flower types, none fails to result in seed production. Once germination has occurred, seedlings produce flowers in the relatively short period of about three months. The limited number of offspring obtained so far is not indicative of a particular genetic system determining the inheritance of style length. Analyses of additional progenies are likely to elucidate the genetic control of heterostyly and its evolutionary significance.

Some Characteristics of a Population of Spruce Trees. Hal DeSelm, University of Tennessee.

During the summer of 1959, 34 *Picea rubens* Sarg. were cut from forests along the crest of the Plott Balsam Mountains near Richland Balsam Mountain in western North Carolina. Weight characteristics, such as bark-wood, along with branch-bole, leaf-tree ratios, rates of accumulation of mass, and chemical constituents are discussed.

CHEMISTRY SECTION

Room 208, Home Economics Bldg.
Norman Campbell, Chairman

The Effect of Coordination on the Reactivity of Aromatic Ligands: Some Further Examples. Mark M. Jones, Vanderbilt University.

The literature contains many examples of reactions carried out on aromatic molecules while coordinated to metallic ions. Two large groups of such examples may be found in studies on the Fries arrangement and those on the Friedel-Crafts reaction. For both of these, numerous examples may be cited where an aromatic ligand undergoes reactions in which the substitution occurs at those positions predicted to be most

reactive in the free ligand. In many of the reactions coordination appears to be a minor deterrent to the facil reaction which can be overcome by simply allowing for it when the catalyst is added.

The nature of the electronic effects which result from coordination can be explained more readily on the basis of molecular orbital ideas than by the use of the valence bond method. The principal effect which must be recognized is that the electronic shifts which occur in most metal complexes are smaller than those predicted by the usual valence bond treatment.

The question of the orientation of electrophilic substitution in pyridine and its various complexes can be discussed on the basis of the electronegativities of the coordination centers. In this instance, the experimental evidence can be explained in terms of the electronegativity differences between the atoms in the coordinate bond.

Research in Analytical Chemistry at Oak Ridge National Laboratory. J. C. White, Oak Ridge National Laboratory.

The research program at the Oak Ridge National Laboratory in Analytical Chemistry is widely diversified. Investigations in the field of radio-chemistry include studies on nuclear methods of analysis, use of activation analysis in analytical chemistry, the application of radioisotopes in analytical chemistry and the resolution of the spectra complex gamma nuclides by electronic means. The effects of radiation on analytical methods is being ascertained to permit the applications of various techniques to highly radioactive solutions. Research is also being conducted on the use of electroanalytical methods with respect to molten fluoride salts. Other programs include the analysis of advance reaction fuels, high temperature-high pressure aqueous and non-aqueous absorption spectrophotometry and the development of instrumental methods for continuous analysis. A brief description of each of these programs is presented.

LCBO Calculation of Ionization Potentials of n-Paraffins. H. B. Kinser and L. J. Schaad, Oak Ridge National Laboratory.

In 1951, G. G. Hall derived an equivalent orbital method, which he used semi-empirically for the calculation of the ionization potentials of n-paraffin hydrocarbons. His calculation involved applying the linear combination of bond orbital (LCBO) procedure to an infinite chain of CH_2 groups and imposing boundary conditions to make the chain of desired length for each paraffin. This neglected the effect of the two terminal hydrogen atoms in each paraffin.

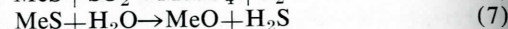
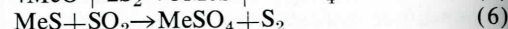
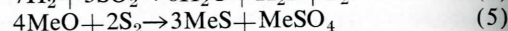
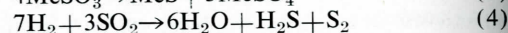
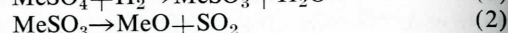
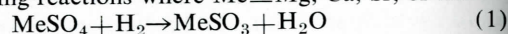
It can be shown that the boundary conditions used by Hall do not impose the precise limiting conditions that he states. We are using the semi-empirical LCBO method with the inclusion of the effects produced by the terminal atoms. The present progress in this research indicates that good correlation of calculated with experimental ionization potentials will be obtained.

Liquid-liquid Interfacial Area Determination Using a Liquid Scintillator. C. V. Chester and J. S. Newman (Currently at University of California, Berkeley), Oak Ridge National Laboratory.

A technique for measuring interfacial area between an aqueous solution of an alpha emitter and a liquid scintillator has been devised. The short-range alpha particles produce light scintillations in the organic phase within a few microns of the liquid interface; these are detected by a photomultiplier, analyzed by pulse circuitry, and counted. A theoretical relation for extracting the interfacial area from the observed count rate was derived. In the technique, it is necessary to include a light absorber to offset the scattering effects of the droplets; otherwise, the specific interfacial area would be independent of the measured count rate. In a preliminary series of experiments, the interfacial area produced in a small mixer was measured and found to be proportional to the 1.6 power of the impeller speed. This technique of measuring interfacial area has the advantage of requiring low activity levels and is amenable to rather exact mathematical analysis.

A Study of the Stoichiometry of the Reduction of Alkaline Earth Sulfates by Hydrogen. W. D. Bond, Oak Ridge National Laboratory.

The reduction of alkaline earth sulfates by hydrogen in the 750-930° C temperature range involves the following reactions where Me=Mg, Ca, Sr, or Ba:



The reaction products can be explained on the basis of these equations. Experimental studies of each of the reactions qualitatively agree with thermodynamic calculations. The solid product of reduction of MgSO_4 was MgO , whereas the solid product for CaSO_4 , SrSO_4 , and BaSO_4 reductions was primarily the metal sulfides. The solid products are explained by the way in which the sulfites of the alkaline earth elements thermally decompose. Magnesium sulfite decomposes primarily by equation (2); calcium, strontium, and barium sulfites decompose by equation (3). The results of the reduction of alkaline earth sulfates with hydrogen suggest a general mechanism for high temperature reduction of sulfates. The proposed mechanism involves reduction of the sulfate to the sulfite with subsequent thermal decomposition of the sulfite and reaction of the reducing gas with the sulfite decomposition products.

Interface Mechanism for Uranium Extraction by Amine Sulfate. W. J. McDowell, Oak Ridge National Laboratory.

In the extraction of metal ions by organic solutions of aqueous-insoluble alkyl ammonium salts, the mechanism by which the metal species transfers across the aqueous-organic interface cannot be determined by the usual equilibrium studies. In an effort to elucidate this mechanism, studies were made of the interfacial tension of the system investigated and the kinetics of the transfer of S^{35}O_4 from an organic phase containing di-n-decylamine sulfate to an acid-sulfate aqueous phase containing uranium. These latter experiments were done in a manner that might detect the transfer of anionic

uranium species from aqueous to organic phase.

Two different aqueous phase situations were examined: (1) low sulfate, where most of the uranium exists as the uranyl ion, and (2) 0.50 M sulfate where most of the uranium exists as the disulfate complex. In the latter situation, an increased rate of S^{35} transfer during uranium extraction (at a given organic/aqueous total sulfate ratio) gave strong evidence for an anion exchange mechanism such as $3(R_2NH_2)_2SO_4 + UO_2(SO_4)_2^{2-} \rightarrow (R_2NH_2)_6UO_2(SO_4)_4 + SO_4^{2-}$. In the former (low sulfate situation), no such evidence was obtained. Since the method of examination was the same in both cases and of comparable sensitivity, it appears reasonable to conclude that evidence for anion exchange in the low sulfate system would have been obtained if such exchange were taking place. Thus, it appears that neutral species transfer, e.g., $3(R_2NH_2)_2SO_4 + UO_2SO_4 \rightarrow (R_2NH_2)_6UO_2(SO_4)_4$ is possible where aqueous neutral or cationic species predominate, and anionic species transfer is possible where aqueous anionic species predominate. No claim is made that the two mechanisms are mutually exclusive.

The Kinetics of Uranyl Sulfate Ion Exchange with a Strong Base Resin. J. S. Watson, Oak Ridge National Laboratory.

A study of uranyl sulfate anion exchange rates with Dowex 21 K indicated that uranyl sulfate in the resin behaved essentially as a single anion independent of individual species in solution. The rates of uranyl sulfate loading on sulfate- or chloride-equilibrated resin was satisfactorily predicted from the self-diffusion coefficients of the ions involved provided the uranium ion had a -2 charge, e.g., $UO_2(SO_4)_2^{2-}$. The rate predicted if the uranium ion had a -4 charge, e.g., $UO_2(SO_4)_3^{4-}$, was notably higher than that observed experimentally. The rate at which uranium is eluted from the resin by chloride solutions also appears to be governed by a single uranium species, but this is not the same ion involved in loading. The ion involved in elution is probably UO_2^{++} , but this has not been confirmed because the self-diffusion coefficient of this ion in an anion resin is very difficult to determine.

C-14 Biosynthesis and Isolation of Gamma-Hydroxy, Gamma-Methyl Glutamic Acid from the Maidenhair Fern, Adiantum pedatum. James R. Azzi and Gordon E. Hunt, University of Tennessee.

Since the simultaneous discovery in 1955 of gamma-hydroxy, gamma-methyl glutamic acid by Virtanen and co-workers and by Pollard and Steward, little clear evidence has been reported on the mode of synthesis or utilization of this new amino acid. In order to obtain uniformly labelled material for feeding experiments, the compound was isolated from the maidenhair fern after exposing a plant to an atmosphere enriched with $C^{14}O_2$.

A potted fern plant was placed in a jar covered with a vacuum dessicator lid, and 100 microcuries of C-14 were released through a glass generator apparatus inserted through the opening in the lid. The plant in the jar was placed in a Percival growth chamber controlled at 70° F and 2200 ft-c of light during the day and was exposed to the atmosphere in the greenhouse

at night. Four similar treatments were used at two-day intervals. The plant then was carefully removed from the soil and divided into two portions, one leaves, one stem and roots. The portions were extracted in 70% ethanol, then water, and the extracts concentrated. Isolation was accomplished by desalting the extract on Dowex-50W in the hydrogen form, removing the acidic amino acids on Dowex-1 in the acetate form, and, after elution of the acidics with acetic acid, reapplication to the Dowex-1 and gradient elution with acetic acid onto a fraction collector.

Techniques used in Evaluating High-Temperature Phase Equilibria: Application to the UO_2 - ThO_2 - O_2 System. H. A. Friedman, Oak Ridge National Laboratory.

By employing several complementary techniques, one may accurately determine high-temperature solid state transitions in binary and ternary oxide systems. Required analytical data are best obtained from examinations with x-ray diffraction equipment, the metallograph, and the polarizing light microscope as well as the electron probe analyzer and the electron microscope. High-temperature transitions in the system ThO_2 - UO_2 - O_2 are established by the results of examinations which were made by utilizing these analytical instruments.

A description of the pressure-temperature-composition relationships limiting the fluorite cubic phase, ThO_2 - UO_{2+x} , depends on the detection of small amounts of second phases formed by the decomposition of the ThO_2 - UO_{2+x} phase. The secondary phases, when they are present in sufficient quantity, may be identified by the use of the x-ray diffraction equipment. These phases, once identified, can be traced past the limit of detection of the x-ray by the metallograph and by the petrographic microscope (on transparent material). Evaluations are made of the utility of each of the described analytical methods for the detection of secondary phases, including the electron probe analyzer and the electron microscope.

GEOLOGY—GEOGRAPHY SECTION
Room 11, Payne Building
M. V. Marcher, Chairman

Cotton Production in Mexico. H. G. McDowell, University of Chattanooga.

Mexico, during the last decade, has become increasingly important as a producer, and especially as an exporter of cotton. Today, it is the leading cotton exporter in Latin America and the second ranking exporter in the Americas, surpassed only by the United States. In recent years, Mexico has supplied about ten per cent of the world's exports of cotton. This country has risen from a minor exporter to major importance and has exceeded such countries as Brazil and Egypt.

The five major regions producing the greater part of Mexico's cotton, nearly all of which is grown under irrigation, are: Matamoros, Mexicali, the West Coast, Laguna, and Delicias.

Several factors help to account for Mexico's rise in the cotton world, namely, (1) the irrigation developments, usually in large scale government projects. (2)

agricultural credit which makes it possible for the grower to purchase necessary materials, and (3) the use of improved production methods.

Several factors favor the maintenance of Mexico as an important producer and exporter of cotton.

Geologic History of the Parana Basin in Central and Southern Brazil. John W. Jewell, Tennessee Division of Geology.

Summary of Ground-Water Levels in Western and Central Tennessee from January, 1952 Through December, 1961. Roy H. Bingham, U.S. Geological Survey, Nashville.

Long-term fluctuations in water level are the result of natural or man-caused factors of a semi-permanent nature and are usually cyclical from season to season and from year to year. Water level data in Tennessee reflect the relationship between water level fluctuations and increasing ground-water use, and they may serve as an index to ground-water availability.

Fluctuations of water level have a greater magnitude in the limestone formations of Central Tennessee than in the sand formations of Western Tennessee. Sand formations have a larger storage capacity, and the water level is affected less by precipitation and pumpage.

Geologic Exploration and Foundation Treatment for Barkley Lock and Dam. Bruce E. Clark, U.S. Army Engineer District, Nashville.

Barkley Reservoir Project is located on the Cumberland River thirty miles above its entrance into the Ohio. It consists of a lock, concrete spillway, earth dam, and a canal joining the reservoir to adjacent Kentucky Lake. The foundation of the concrete dam, lock and powerhouse is on Mississippian limestone. The principal foundation problems have been due to the systems of more or less vertical, clay-filled solution channels which crisscross the area. The largest of these, which originally crossed under the downstream gate of the lock, is about fifty feet wide and extends over ninety feet below the general top of rock. The whole dam was shifted to avoid placing a hydraulic structure over this solution channel; it would have required very difficult and costly measures to prevent serious leakage under the structure. As a result of the shift of dam location, part of the lower lock guide wall had to be built over this clay-filled channel, but this only required bridging the solution channel, as the guide wall does not hold back water. The lock was completed in 1961 and the foundation of the powerhouse, as of the fall of 1962, is nearly complete. Four narrow but deep solution channels were encountered which required cut-off plugs; these were constructed by excavating vertical shafts to cut the channels near the upstream edge of the dam and backfilling them with concrete. Because of detailed drilling before design of the structures, all of the foundation problems encountered thus far were anticipated.

Rediscovery of the Murray Gap Fossil Locality, Blount County, Tennessee. Robert A. Laurence, U.S. Geological Survey.

In 1889, C. D. Walcott collected Early Cambrian fossils on Chilhowee Mountain, Blount County, Tennessee, but for many years the location of the site and

stratigraphic position of the source beds have been uncertain. During the summer of 1962, the writer re-discovered Walcott's locality and collected many specimens of primitive bivalved arthropods from the lower sixty feet of the Murray Shale in roadcuts along the new Foothills Parkway at Murray Gap. The Murray Shale and overlying Hesse Quartzite are now considered to be Early Cambrian (?) [Sic]. These discoveries indicate that their age is, without question, Early Cambrian. No trilobites or brachiopods have been found in the Murray Shale to date, nor have fossils been found in the lithologically similar Nichols Shale.

Grassy Cove, a Comparative Case Study in Microgeography. Milos Sebor, Tennessee Polytechnic Institute.

During the last year, field work was carried out in Grassy Cove, a representative karst region of the Cumberland Plateau. The results of this study demonstrate (1) the uniqueness of limestone topography as a combined product of both mechanical and chemical erosional processes, hence one of the most changeable relief features of the third order; (2) the work of plateau-forming agencies and the function of sandstone layers on upland; and (3) the human geographic aspects of small limestone valleys as social units of a high unifying power, studied on a comparative basis.

Comparisons are made between similar formations of Tennessee, Moravia, Slovenia, Dalmatia, and the Causses. In all of these districts, which have been investigated, the dynamics of the physical processes contrast with the static forms of social life and cohesiveness of the communities.

An attempt also is made to clarify the Slavic terminology of karst landscape established by Jovan Cvijic, such as *dolina*, *uvala*, *polye*, *lapie*, *struga*, *lokva*, and *blato*. In English literature, these terms are confused or used inconsistently.

New Concepts of the Geology of the Alps and Their Influence on Our Understanding of the Appalachian Mountains. Richard G. Stearns, Vanderbilt University.

The Alps have been investigated intensively and nearly continuously by geologists for over 100 years, and many of our most useful ideas in geology were conceived by the men of genius who worked there. As knowledge advances, however, ideas change, and new ones take their place. The present is a time of great advances and changes in ideas on the history of development of the Alps. These changes have been brought about and made possible by new techniques, new ideas, and additional information through continued geologic mapping and drilling.

Important among the new or reemphasized techniques are (1) direct age dating of rocks by geochemical means, (2) geophysics and (3) micropaleontology, particularly of sparsely fossiliferous rocks. Important new concepts are (1) gravity tectonics, (2) control of sedimentary lithology by structural movements, and (3) paleogeographic reconstruction. These techniques and ideas have been employed, in combination with more detailed geologic mapping, to revolutionize understanding of Alpine geology.

It is important that American geologists working

the Appalachian chain be aware of the latest developments in the Alps. Through ideas we must continue to be bound, in part at least, to this region where there is a more precise knowledge of the geologic processes that formed rock types and distributed them tectonically. We must thus be continually aware of the following possibilities in the Appalachians: (1) large nappes of great movement which may involve all lithologies from granite slabs, with inherited structural details, to unconsolidated materials completely controlled lithologically and tectonically by synchronous orogenic events; (2) a complex system of basins and swells changing from time-to-time which ultimately may have been tectonically dismembered and parts moved great distances; (3) the possibility of structures riding "piggy-back" on others for unknown distances; (4) the possibility of apparently conformable rock masses actually being a substituted cover because of bedding plane thrusting; (5) the possibility of autochthonous and allochthonous structures laterally merging, or an earlier movement of one type later controlling development of another; (6) the possibility of large strike slip movements; and (7) the possibility of large scale gravity movements singly or in combination with tectonics of a deeper seated origin. Consideration of these might lead to a more complete understanding of the possibilities of Appalachian geology.

MATHEMATICS SECTION
Room 6, Payne Building
William A. Small, Chairman

A Preliminary Report on the Statistical Aspects of a Study on Feed Grain Movements in Tennessee. J. K. Robertson, University of Tennessee.

The feed requirements of the animal population of Tennessee, coupled with the deficit feed grain position of the State, have made it necessary to determine the least-cost equilibrium of transporting feed grains into the area from out-of-state sources for rail, barge, and motor carriage. This equilibrium model could effect a savings in the total transfer costs that may be passed on to the consumer.

The statistical data necessary for this model were obtained through a stratified sampling procedure of the grain merchandising firms of the state. The firms were classified into four strata on the basis of storage capacity from a listing by the United States Department of Agriculture.

One of the problems occurring most frequently was that of a bad frame. Non-cooperators presented another problem. Also present was the non-statistical problem of poor record keeping.

A Comparison of Numerical Solutions to a Simple Differential Equation. Walter W. Graham, Vanderbilt University.

As a practice problem in the use of the digital computer, numerical solutions were sought to the differential equation

$$y' = \frac{1}{1 - 0.2 \cos y}. \quad \text{The analytical}$$

solution can be obtained readily and checks can be determined exactly at $x = n\pi$. Numerical solutions will

be obtained at intervals of $x = \frac{\pi}{50}$ up to $x = 2\pi$ by

means of Euler's method, Heun's method, Runge's method, and Milne's method. Results will be shown to 8 decimals and comparisons observed. Other solutions will be shown for every multiple of $\pi/50$ for x by using Newton's method to solve the equation obtained from the analytical solution.

The Number of Solutions of a Certain Congruence. J. T. Cross, The University of the South.

This paper is concerned with a brief discussion of a method for determining the number of solutions of the congruence,

$$(1) \quad X^k + aY^2 \equiv n \pmod{p^r}$$

where p is an odd prime number, a and n are integers with n arbitrary and $(a,p) = 1$, r is a positive integer, and k is a positive integer such that $(k,p) = 1$ and $(k,p-1) > 1$. Solvability criteria for (1) are mentioned and a few examples are considered.

A New Model for Finite Geometries. J. Houston Banks, George Peabody College.

A set of axioms is stated, and a model is demonstrated which involves the representation of undefined concepts, such as points and lines, by letters and words respectively.

An Application of Calculus of Variations to a Multistage Navigation Problem. M. G. Boyce, Vanderbilt University.

A simple form of Zermelo's navigation problem, extended to involve multiple stages, was solved to illustrate some aspects of calculus of variations methods in the optimization of satellite trajectories.

Abstract Modern Dialectics. William A. Small, State University College, Geneseo, New York.

Assuming the dialectical triad as the basis for dialectics as stated by Frederick Engels: (1) The transformation of quantity into quality and vice versa; (2) the interpenetration of opposites; and (3) the negation of the negation. It is then shown that these three laws are different interpretations of the abstract representation (x,y) of the dialectical triad.

MEDICAL SCIENCES SECTION
Room 103, Industrial Arts Building
James W. Ward, Chairman

The Effects of Various Steroids and Diethylstilbestrol on the Movement of Na^{22} and K^{42} in the Ehrlich Ascites Tumor Cell. William C. Heird and Allan D. Bass, Vanderbilt School of Medicine.

One hypothesis to explain the action of steroid hormones is that these agents alter the permeability of cell membranes. To study this, a filtration procedure was developed by which the effects of various steroids and diethylstilbestrol on Na^{22} and K^{42} movement in the Ehrlich ascites tumor cell were determined. These agents enhanced the total loss and increased the rate of loss of K^{42} from the cells. No effect on K^{42} uptake or on uptake or loss of Na^{22} was observed.

Diethylstilbestrol was the most active agent studied; testosterone was the most active steroid.

Further experiments suggested that the increased K^{42} loss did not result from an inhibition of energy yielding processes or from an enhancement of exchange diffusion. It would appear, therefore, that the above speculation does explain the action of these agents in this system.

The Circulation in the Newborn Calf; A Method of Study. James E. Leathers, J. T. Reeves, University of Kentucky Medical Center.

During interuterine life, the pressure in the pulmonary and systemic arterial trees are equal. However, in the adult, the pulmonary arterial pressure is only 1/5 that in the systemic arteries. The factors which, shortly after birth, are responsible for the transition of the pulmonary circulation from a high pressure to a low pressure system are not clearly understood. Difficulties in previous investigations of the pulmonary circulation in the neonatal period have been the small size of the newborn of the species studied, the use of anesthetics and thoracotomy, and the absence of serial measurements of blood flow and ventilation in the same individual with increasing age.

Cardiac catheterization was performed on 20 newborn calves within the first 12 hours of life and serially thereafter up to the age of eight weeks. The calves were restrained standing or lying on their sides; after the initial manipulation, struggling rarely occurred. They received only local anesthesia into the site of intubation. Percutaneous needle puncture of the external jugular vein permitted the introduction of a curved tip catheter which was then passed through the right heart chambers into the pulmonary artery. The position of the catheter was determined by the contour of the pressure pulse which rendered fluoroscopic visualization and direct placement at thoracotomy unnecessary. A muzzle mask permitted the collection of expired air for the measurements of oxygen uptake and ventilation. Pulmonary blood flow was by the Fick method.

The high pulmonary arterial pressure following birth decreased rapidly during the first few days of life reaching "mature" levels at about one week of age. In contrast, the systemic arterial pressure increased slowly during the eight weeks of life. The pulmonary ventilation, within two to twelve hours after birth, was equal to that on subsequent days and was capable of maintaining an arterial saturation of 91%. The pulmonary blood flow also changed little during the first weeks of life.

These experiments have shown that the changes in the pulmonary and systemic circulations following birth can be easily studied in the newborn calf under relatively physiological conditions and without apparent harm to the animal. Furthermore, they have demonstrated a marked contrast between the behavior of the pulmonary and systemic circulation within a few hours after birth.

The Experimental Production of Hydrocephalus. T. M. McCutchen, Vanderbilt School of Medicine.

The approaches to the production of hydrocephalus in experimental subjects may be divided arbitrarily into two categories, depending upon the maturation of the

subject at the time the approach is initiated. Those approaches initiated before birth of the subject, i.e., before or during gestation, may produce associated abnormalities of the skeletal or nervous systems. The most successful of these approaches have been maternal vitamin A deficiencies in the rabbit and vitamin B₁₂ and/or folic acid deficiencies in the laboratory white rat, the abnormalities appearing in the offspring. Also successful are irradiation of the pregnant mother rat at a certain period of her gestation, the injection of certain toxic substances into the pregnant mother rat, and genetically transmitted hydrocephalus in mice.

The most successful procedures initiated after birth of the subject are the surgical obstruction to the normal flow of cerebrospinal fluid, the occlusion of the venous drainage of the brain, and the injection of irritating substances into the channels of cerebrospinal fluid flow. Larger subjects are preferable because of the trauma of these procedures.

Effect of Specific Activity on Physiological Tracers (Sodium-22 in Goldfish). Granvil C. Kyker and Barbara Chastain, Oak Ridge Institute of Nuclear Studies.

Special emphasis is given to the effect of the chemical dose of stable ion on the validity of measurements with a radioactive tracer. Goldfish, swimming in various dilutions (1:5, 1:50, 1:500, 1:5000) of physiological saline, each containing the same amount of radioactive tracer (sodium-22), show distinctly different uptakes of the tracer. The order of uptake is inverse to the concentration of sodium chloride. Conversely, the total amount of sodium transferred from the pool to the fish parallels the order of concentration. Both radioassay and autoradiographic measurements illustrating these conclusions are presented. In addition, measurements in the presence of anesthetic agents used for fish suggest the convenient procedure of a laboratory exercise for reliable demonstration of carrier on radioisotopic tracer applications. This work was done under contract with USAEC.

Hydrocortisone Potentiation of Catecholamines. John C. Besse and Allan D. Bass, Vanderbilt School of Medicine.

Experimental evidence indicates the existence of an intimate relationship between adrenal cortical hormones and responsiveness of the cardiovascular system. Observations of Lecompte on hydrocortisone potentiation of some motor actions of epinephrine have been extended. We have observed potentiation by hydrocortisone of epinephrine on blood pressure in normal, vagotomized, and spinal-vagotomized dogs. Preliminary experiments with rabbit aorta strips show hydrocortisone potentiation of epinephrine induced contractions. Response to isoproterenol, an adrenergic vasodilator, and the vasodilator response to epinephrine after administration of dibenzylamine, an adrenergic inhibitory agent, are also potentiated by hydrocortisone; response to norepinephrine does not appear to be significantly modified. A study in dogs comparing hydrocortisone and cocaine as a well-known potentiator of vascular responses to epinephrine and norepinephrine, showed that cocaine potentiates the response of all three catecholamines. The data would seem to indicate that the mechanism

hydrocortisone potentiation is being exerted at the sites of catecholamine target cells.

A Comparison of the Effects of Lecithin and Polyunsaturated Fats On Free Serum Cholesterol. L. Hunter Elrod, Tennessee Polytechnic Institute.

Previous short term studies in this laboratory have shown that there is a definite correlation between free serum cholesterol and serum lecithin content.

This is a progress report on work closely related to the above studies but using a larger number of animals, extending the test period, and including a polyunsaturated oil in the diet.

Using five groups of animals, it is hoped to determine the effects of lecithin and safflower oil on free serum cholesterol. Group I serves as the control; Group II receives a diet high in cholesterol; Group III receives a high cholesterol and lecithin diet; Group IV receives a diet high in cholesterol and safflower oil; and Group V receives cholesterol, lecithin and safflower oil.

Time Lapse Studies of Virus Induced Changes in Tissue Culture. John B. Thomison, Vanderbilt School of Medicine.

When measles virus is introduced into tissue culture, it produces syncytial masses by fusion of cells. These are of two types, and possible reasons for this are discussed. Evidence is presented that infection may be spread from cell to cell by transfer of infected material across cell membranes. The question of whether fusion of cells into the syncytial masses is or is not permanent, and the mechanism of fusion of cells are discussed.

The paper consists of a time lapse motion picture, with commentary.

A Comparison of Steroids on the Serum Protein Fractions of Rats. David N. Radabaugh, Tennessee Polytechnic Institute.

Previous studies in this laboratory have established certain effects of cortisone, ACTH, insulin and irradiation upon serum protein fractions of rats. Work is being continued to determine the effects of the steroids cortisone, progesterone, and testosterone upon the serum proteins of rats. One hundred hooded rats have been divided into groups of five. During a span of five months, injections will be given every two days. Research on the five groups will last for different periods of time. Group one, which has been started, will be injected for five months, group two for four months, group three for three months, group four for two months, and group five for one month. Serum protein analyses are being done two, five and seven days after initial injections, with further analysis being made at weekly intervals.

Changes in Blood Constituents and Evidence of Central Nervous System Involvement Resulting from Anthrax Toxin. David Franklin Fitzpatrick, Lt. (CmlC), Jerry Stanley Walker, Lt. (VC), Morris Albert Rhian, Frederick Klein, Ralph E. Lincoln, U.S. Army Biological Laboratories, Fort Detrick, Frederick, Maryland.

After rabbits were challenged with steril anthrax toxin, cholinesterase in the blood increased initially, but after 6-12 hours began a gradual decrease to 40-50 per cent of that of the control. Cholinesterase inhibition also was observed in blood of monkeys infected with

systemic anthrax. When rabbits and Wistar rats were challenged with toxin, a marked increase of immature white blood cells and the appearance of immature red blood cells were noted. Paralysis of both the spastic and flaccid type and a massive pulmonary edema were observed. These observations suggest central nervous system involvement and the possibility that observations on cholinesterase inhibition and/or shifts in white blood cells may be adapted to detect establishment of systemic anthrax prior to the observance of the terminal septicemia.

PHYSICS—ASTRONOMY SECTION
Room 6, Home Economics Building
Sara Wood, Chairman

A Neutron Spectrometer. Brother George Carney, Christian Brothers College.

A relatively inexpensive fast neutron generator (\$3,000) is now available which does not have the usual problems of large installations, i.e., the need for vacuum pumps or difficulties in maintaining a well focused beam. Therefore, it is conceivable that work in fast neutron physics can be done at the undergraduate level. Difficulties in electronic methods of neutron energy measurements are discussed with a suggested solution which was worked on at Louisiana State University this past summer. A resolution of no better than 20% can be obtained, but possibly this can be improved by more sophisticated electronics.

The Number of Bound States in Potentials of Finite Range. W. G. Holladay, Brooks Thomas, and Charles Ray Smith, Vanderbilt University.

Despite the long history of eigenvalue-eigenfunction problems in mathematics and physics, there do not appear to be any general and exact methods for determining the number of discrete energy levels in potentials that admit of a finite number of such levels, apart from simply counting them after they are calculated. This paper is concerned with the use of the WKB approximation in this problem. For two particular one-dimensional, finite range potentials, it is shown that the WKB approximations yield results that are very close to those given the Schroedinger equation. For the three-dimensional Yukawa potential used in nuclear physics and plasma physics, the WKB approximation is used to compute $N(l)$, the total number of bound levels for a given angular momentum l , and N_T , the total number of bound levels. These results, which we argue are quite accurate, are somewhat at variance with those previously published.

The Growth of Single Crystals by the Czochralski Method. L. M. Ogilvie, Austin Peay State College.

A furnace has been constructed for the growth of bismuth and antimony single crystals by the Czochralski method. The description of the apparatus includes the growing chamber, the resistance-type heater, the pulling system, and the vacuum system.

Orientation of the crystals was determined by the use of a Laue back-reflection camera. The crystals were cleaved and etched on the cleavage planes to determine possible areas of dislocations.

Summer Student Trainee Program in the Physics Division. J. L. Fowler, Oak Ridge National Laboratory.

During the last four years the Oak Ridge Institute of Nuclear Studies and the Oak Ridge National Laboratory have offered summer appointments to a limited number of juniors from colleges in which graduate research is not normally carried on. This program is designed to bring science students in contact with modern research in order to stimulate them to continue their careers through graduate study. In this Student Trainee Program the Physics Division of ORNL has had a total of twenty-one participants, these having been selected from about one hundred applicants mostly on the basis of individual scholarship and recommendations. At the end of each summer, assignment letters are written to the students' major professor and to the President of their college describing the students' experience at the Laboratory, and in most cases recommending them for graduate study. Partial results from a survey show that approximately three-fourths of the 1959-1961 Physics Division students are working on a doctor's degree.

The New King College Observatory. William W. Rolland and Edward W. Burke, Jr., King College.

A twelve and one-half inch reflecting telescope is being mounted in a new observatory on the King College campus. The telescope building is a steel structure which rolls away from the telescope when it is in operation. An auxiliary building will contain a shop, darkroom, library, chartroom and kitchenette. A photoelectric study of variable stars is planned with this new facility.

A Photoelectric Study of Visual Binary Stars. C. R. Tolbert, Dyer Observatory, Vanderbilt University.

Some evidence has been presented in the last several years indicating that one or both components of many visual binary systems are not main sequence stars; that is, they do not fall on the line defined by most other stars in a brightness versus temperature plot. This deviation from the main sequence is particularly interesting since it is assumed that both components were formed at the same time and from the same gas cloud. Therefore, it would be expected that they would have the same history and both be similarly placed relative to the main sequence.

To determine if these discrepancies might be the result of differing rates of evolution for stars of differing temperatures and masses, and to provide data for a thorough statistical study of the problem, we have undertaken a photoelectric survey of about 100 binary systems. A revue of the background and preliminary results of this survey are presented.

Broadening the Base for Basic Physics. M. S. McCay, University of Chattanooga.

Coordination or articulation of the high school and college courses in basic physics is needed for a number of reasons: (1) High school teachers of excellent advanced physics courses are rightfully asking, "What will you offer our superior physics students in college? Will they repeat the same course or use the same text?" (Some high schools use the standard "College Physics" textbooks.) (2) More efficient treatment of basic physics

concepts would be possible under well-planned programs. (3) Additional laboratory experiences could be provided if repetition were minimized. (4) "University physics" can be extended to include subjects and phenomena now neglected, or delayed for treatment in intermediate courses. The current effort to produce a coordinated program of basic physics instruction in high schools and colleges should provide broader insight into the principles of physics and their significance.

ZOOLOGY SECTION

Room 2, Home Economics Building
James J. Friauf, Chairman

Chromosomal Variation Among Mutant Strains of a Heavily Irradiated Cestode. A. W. Jones and J. A. Dvorak, University of Tennessee.

Cestodes were irradiated in the larval (cysticeroid) stage with 15,000 roentgens gamma (Co 60) for eight generations, and adult worms of the fourth generation and eighth generation were examined cytologically. Among 10 worms of the 4th generation, several different karyotypes (chromosomal morphologies) were recognized, although the chromosome number (diploid 12) remained constant. Evidence of chromosome breakage and recombinations was seen in meiosis in oocytes and spermatocytes, where translocation had resulted in synapses involving more than two chromosomes. Among 13 worms of the 8th generation, one worm had the abnormal chromosome number $2r=13$, while several had fragments or very minute supernumeraries in this chromosome complement. Distinctly different karyotypes were seen in 6 of the 13 cestodes; the others could not be analyzed completely. As a result of this work, several mutant strains of the cestode are being investigated in terms of biological fitness, morphological divergence from the normal, and cytological stability, using as "labels" chromosomal patterns such as those discussed above. Supported in part by AEC contract AT40-1 1749.

The Morphological Effects of Radiation on the Eggs of Hymenolepis diminuta. D. E. Darnell Jones, University of Tennessee.

Comparisons were made between embryos produced by normal, non-irradiated tapeworms of *Hymenolepis diminuta* and the embryos produced by worms of the same species which had received a cumulative dosage of 120,000 roentgens. It was found that the frequency of embryos which did not have the usual number of hooks was less in the irradiated sample than that in the non-irradiated sample. An abnormal phenotype was observed in the irradiated sample which was not present in the normal group, and it appears to be the result of the effects of radiation. Its main characteristic is an enlarged embryo with no hook development. The frequency of small, under-developed eggs was less in the irradiated sample than in the normal group. The hook length, embryo diameter, and diameter of the oncosphere, as well as the size limits for these characteristics, do not appear to have been affected by radiation. Research supported in part by AEC Contract AT 40-1 1749 and by NSF Grant No. 15691, Undergraduate Research.

Cultures of Dissociated Thyroid Cells from Rats Exposed to Reduced Barometric Pressure. John M. Mallette, Tennessee A&I State University, and Adam Anthony, Pennsylvania State University.

Thyroid glands from adult rats acclimated to a reduced barometric pressure of 380 mm Hg were removed, dissociated in trypsin, centrifuged, and the dissociated tissue pellet grown in tissue culture, the chick chorio-allantois or the anterior chamber of the rat's eye. Similar cultures were made from intact thyroid tissue which was not dissociated. The following conclusions are based on microscopic analyses of more than 150 *in vitro* and *in vivo* cultures: (1) dissociated thyroid cells from adult rats can reconstitute functional thyroid tissue, as evidenced by the formation of follicles with colloid; and (2) the nature of the culture medium did not appear to influence the capacity for differentiation and formation of follicles.

Thyroid cells from altitude acclimated rats behaved the same as those from rats kept at ambient pressures with respect to the pattern of follicle reorganization after trypsin dissociation. Differences were found, however, in the rate of growth and the secretory capacity of the epithelial elements. In general, thyroid tissue from hypoxic rats showed more secretory activity than corresponding tissue from control rats. Furthermore, thyroid implants became established more rapidly and grew faster when cultured in the eyes of altitude acclimated rats than in the eyes of control rats.

Some Features of the Chick Embryo Hemoglobins. R. C. Fraser, University of Tennessee.

Analyses by column chromatography and electrophoresis on cellulose acetate has revealed that there are basically two hemoglobins in the chick embryo which change in concentration during development. The appearance of a third hemoglobin in electropherograms produced at higher pH values may be an artifact arising from the procedure; a corresponding globulin has not been demonstrated.

The accumulated evidence indicates that the isoelectric point of fraction 1 hemoglobin (embryonic type) is at pH 7.8, that of fraction 2 Hb (adult type) is at pH 8.55, and that of fraction 3, if it exists, is at pH 9.5.

The Spermatozoa of Cryptobranchus. C. L. Baker, Southwestern College at Memphis.

The sperm of *Cryptobranchus bishopi* conforms to the general pattern of urodelean sperm structure yet has several distinctive generic features. The prominent cell membrane does not extend down the middle piece, no neck piece is present and no mitochondria pass down to the middle piece. The flagellum arises quite early from the granule, extends along the axial filament for 170 micra and then distally beyond for 160 micra and is vibratile from early origin. In the mature sperm, the flagellum has drawn into a sheath alongside the axial filament and is apparently planar in motility with prominent waves; the free tail piece is only 20-30 micra in length. Each wave has a secondary, transverse curvature due, apparently, to pressure from the enclosing sheath. Energy for motility arises from mitochondria in large blebs on the nucleus, and the movement of in-

dividual waves indicates the passage of energy inside the flagellum.

Some Remarks on the Branchiobdellids of Mexico. Perry C. Holt, Virginia Polytechnic Institute.

Sixty-four collections of Mexican branchiobdellids have been acquired as gifts from individual collectors, the Instituto de Biología del Universidad Nacional de México and through the efforts of the writer during an expedition in July, 1962. The new species recognized at this time appear to be related to Southern Appalachian and Ozarkian forms. These branchiobdellid species, currently being figured, described and classified, tend to confirm theories that ascribe to the Mexican highlands the status of a refugium during the Pleistocene. This work has been supported by National Science Foundation grants NSF-64439, NSF-G69828 and NSF-GB372.

Problems of Speciation in Green Hydras. R. R. Bryden, Guilford College, North Carolina.

Recent discoveries concerning the stimulus for sexuality in hydras has enabled us to see greater numbers of zygotes. In the Genus *Chlorohydra*, several different zygotes have been described in hydras with few other morphological differences. A comparison of the recently described *Chlorohydra hadleyi* and *Chlorohydra viridissima* is given. In addition, a third type of zygote has been found on a green hydra which is morphologically indistinguishable from either of the described species except with respect to this zygote.

An Ecological Study of the Brown Trout, Salmo trutta fario, in a Stream Free from the Competition of Other Species of Fish; A Progress Report. James D. Little, Tennessee Polytechnic Institute.

In the fall of 1962, the fish population of Pine Creek, DeKalb County, Tennessee, was completely eradicated by the use of rotenone. All fish were collected and identified in each of three predetermined ecological zones. Brown trout fingerlings then were stocked in the stream, and a series of studies were begun to determine: (1) the rate of growth of brown trout in a stream free from the competition of other species of fish; (2) the rate of growth of these fish as compared to the rate of growth of the trout in the stream before eradication; (3) the ability of the brown trout to winter over and summer over in a stream free from the competition of other species of fish; (4) mortality of brown trout in this stream; and (5) the rate at which other species of fish reenter this stream.

Herpetofaunal Areas of Eastern Tennessee. R. M. Johnson, Tennessee Polytechnic Institute.

The elements of the herpetofauna of eastern Tennessee are classified as extraneous, intraneous, or endemic species and subspecies. Analysis of the known horizontal and vertical distributions of these amphibians and reptiles indicates that they occur in distinct horizontally and vertically distributed assemblages. These assemblages, correlated with climate and vegetation, are the basis for defining four herpetofaunal biotic areas. These areas are independent of physiographic regions of eastern Tennessee.

Habitat Determination Based on Factor Analysis. Floyd M. Ford, Austin Peay State College.

A coefficient of concordance for the forty-eight species of the collembolan family Isotomidae found in the Central Basin was calculated by the formula

$$X = \frac{w}{a+b}, \text{ where } w \text{ is the number of times two different}$$

species occurred together, a and b are the number of times each of the species occurred alone. The data was analyzed on a 650 IBM computer system. A total of eight factors were extracted from the concordance data showing the per cent of communality, and with factor loadings recorded to six decimal places. Positive factor loadings ranged from .62 to .018. No loading below .20 was considered significant for interpreting the factors responsible for the species associations.

An interpretation of the factor analysis reveals that there are two major habitats for isotomids in the Central Basin: (1) the terrestrial, epigeic litter and moss habitat, and (2) the water habitat. These two major habitats are subdivided.

A Quantitative Study of the Plankton of Stones River, Tennessee. John G. Parchment, Middle Tennessee State College.

Data are based on the examination of net plankton preserved in formalin. During the period of study, the plankton population averaged 698.5 individuals per liter. If total collections from all stations are considered, members of the Myxophyceae were the most abundant phytoplankters (67.9%) and Rotifera were the most abundant zooplankters (79.2%). The phytoplankton-zooplankton ratio was 2.5:1. Graphic analysis of seasonal distribution suggests that zooplankton numbers may be correlated with temperatures, but phytoplankton pulses appear to be more closely related to substances dissolved in the water.

A Method for the Microscopic Observation of the Cestode, Hymenolepis microstoma, in vivo. G. R. Webber, University of Tennessee.

Since the habitat of *Hymenolepis microstoma* is the thin-walled bile duct of the mouse, this worm can be observed *in vivo*. By the method of Palmer and Wilkins, microscopic examination is possible. The apparatus consists of (1) a transparent well or window to receive the objective of a microscope, and (2) a lucite rod to introduce light beneath the bile duct, which is supported against the window by the lucite rod. The anesthetized animal may be observed for as long as several hours by this method.

First developed for use in the rat, the equipment was redesigned to conform to the body dimensions of the mouse. Also, better support for the bile duct was required, and, since it was found that the parasite was sensitive to pressure, a wide support had to be designed and built.

Several observations of the tape worm have been made. The *in vivo* behavior was found to be somewhat different from that *in vitro*. The migration of the scolex and neck region of the early stages of infection have been observed, as well as characteristic undulating movements of older worms. The strobila (body) of the latter remained motionless for several minutes and then violently changed position. Whenever the host moved

spasmodically, the worm was observed to contract, resulting in a thickening of the body, perhaps a response enabling the worm to retain its position in the bile duct. Attempts to photograph the parasite *in vivo* have been only moderately successful. This work supported, in part, by AEC contract AT 40-1 1749 and by NSF Grant No. 21752.

Investigation of a Suspected Case of Swimmer's Itch in Tennessee Waters. Billy G. Isom, Tennessee Stream Pollution Control Board.

Organisms responsible for schistosome dermatitis, commonly called swimmer's itch, Gulf Coast itch, clam digger's itch or cercarial dermatitis, belong to the genus *Schistosoma*, and there are a number of species within the genus that cause dermatitis, an example being *S. douthitti*.

In North America, endemic centers have been found in Saskatchewan and Manitoba, and in Wisconsin, Michigan, Minnesota and Iowa. Reports of outbreaks also have been received from Illinois, North Dakota, Nebraska, Texas, Florida, Washington and New York.

No schistosome cercaria were found in *Physa microstoma* taken from the lake studied. It is possible the adult snail population, in which the initial infection was thought to occur, had passed their terminal period when the study was initiated.

The Labeling of Hymenolepis microstoma with H³-cytidine. J. A. Dvorak and A. W. Jones, University of Tennessee.

In vivo incorporation of H³-cytidine was demonstrated in the bile duct cestode *Hymenolepis microstoma* by autoradiography. The isotope in a concentration of 10 $\mu\text{c}/\text{cc}$ was injected into a cestode-infected mouse bile duct. After a suitable incubation time, the entire bile duct containing the cestodes was fixed, serially sectioned and autoradiographed. Sites of active nucleic acid synthesis were correlated with parenchymal, ovarian and other tissues of the worm. The tissues of the parasitized mouse were used as a natural control. This work supported by AEC Research contract AT 40-1 1749.

Some New Records of the Fresh-Water Jellyfish Craspedacusta sowerbyi in the Cumberland River Basin. Billy G. Isom, Tennessee Stream Pollution Board.

This paper presented only by title.

ORGANIZATION MEETING
SCIENCE-MATHEMATICS TEACHER SECTION
Saturday, November 24, 1962
Arlo I. Smith, Acting Chairman

Junior Academy of Science Activities. M. S. McCay, University of Chattanooga.

Opportunities for the Teacher, the Student and the Academy. James Delano, AEDC, Tullahoma.

The Tennessee Science Talent Search. James L. Major, Clarksville High School.

The New Visiting Scientist Program. Roger Rusk, University of Tennessee, Knoxville.

Objectives, Services and Programs Possible in the Teacher Section. Mrs. Thelma Boynton, Pikeville; Mr. Hilburn H. Blakley, Kingsport; Mrs. Burt Francis, Nashville.

Experiences with BSCS Biology in High School. Mrs. Frances Wild, Memphis.

SECTION OFFICERS FOR THE YEAR 1963

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 Secretary: James M. Moore, Univ. of Tenn. Martin Branch, Martin.
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Chemistry Section:

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THE TENNESSEE JUNIOR ACADEMY OF SCIENCE
 AFFILIATED WITH SCIENCE CLUBS OF AMERICA

Sponsor: Myron S. McCay
 Informational Meeting
 Saturday, November 24, 1962
 Room 6, Payne Building
 Gordon Pennebaker, Chairman

TJAS Regional Science Lectures. Mrs. Mathew Rayburn, Martin College.

TJAS Regional Science Day Programs. Robert L. Wilson, University of Chattanooga.

TJAS Chapter Activities. Arlo I. Smith, Southwestern at Memphis College.

TJAS Science Day Program. M. S. McCay, University of Chattanooga.

TJAS Junior Science Honors Day. Chris P. Keim, Oak Ridge National Laboratory.

TJAS Distinguished Science Teacher Awards. W. B. Jewell, Vanderbilt University.

Other Junior Academy Opportunities. James Delano, AEDC, Tullahoma.

NEWS OF TENNESSEE SCIENCE

(Continued from Page 51)

who have completed the preceding first session. Chemical interpretation of infrared spectra will be stressed both in lectures and in daily workshops on the Interpretation of Spectra. The lecturers will include: Norman B. Colthup, American Cyanamid; Walter Edgell, Purdue University; Nelson Fuson, Fisk University; Henry Morgan, Oak Ridge National Laboratory; Robert O'Connor, Southern Utilization Research Division of the U.S. Department of Agriculture; Ernest A. Jones, Vanderbilt University; James R. Lawson, Fisk University; Clara Smith, Infrared Consultant and George Wilkinson, University of London.

The registration fee for one or both sessions is \$10.00. The tuition fee for the first session is \$100.00, for the second session, \$125.00. Further information and application blanks may be obtained by writing to the Director, Fisk Infrared Institute, Fisk University, Nashville 8, Tennessee.

A seven-week Summer Institute in Radiobiology, with emphasis on radiation ecology, will be conducted by the Oak Ridge National Laboratory and the Oak Ridge Institute of Nuclear Studies in cooperation with the Ecological Society of America. This institute, sponsored by the National Science Foundation and the U.S. Atomic Energy Commission, will be held June 10 through July 26, 1963.

The purpose of the course, taught by a staff of twenty-five specialists, is to provide training in the environmental aspects of nuclear science for ecologists. It is designed for those who wish to utilize radioisotopes and other new tools in their teaching and research.

The deadline for return of application blanks was February 15, 1963. Notification of selection for the course was made March 5.

Expanded activities in the field of health protection have resulted in recent additions to the Biology Branch of the Atomic Energy Commission's Oak Ridge Operations. New personnel include Raymond L. Herven, health physicist, formerly of the Cincinnati Area Office, AEC; William Thornton and Howard V. Heacker, health physicists, both formerly of the Oak Ridge National Laboratory; and William A. Pryor and Wiley A. Johnson, nuclear safety specialists. Mr. Pryor was formerly on the staff of General Electric's nuclear propulsion program, Cincinnati, and Mr. Johnson was

(Continued on Page 74)

HAVE YOU PAID YOUR DUES?

The collection of delinquent dues costs your Academy money! We believe you would rather have this money spent for scientific activities. Don't delay, send your dues TODAY.