

PROCEEDINGS OF THE TENNESSEE ACADEMY OF SCIENCE  
FOR 1964

JAMES L. WILSON, SECRETARY  
*Belmont College, Nashville, Tennessee*

MEETINGS OF THE EXECUTIVE COMMITTEE  
*February Meeting, Vanderbilt University*

The Executive Committee of the Tennessee Academy of Science was called to order by President James W. Ward at 7:45 PM on February 22, 1964, in Room C-2309 of the Anatomy Department of the Vanderbilt Medical School. Members present were Clinton L. Baker, Frank H. Barclay, Norman Campbell, Don Claypool, Willard B. Jewell, Gustave H. Lundberg, Gordon B. Pennebaker, Elsie Quarterman, James W. Ward, and James L. Wilson. James Major, chairman of the Science Talent Search Committee, and Roger Rusk, director of the Visiting Scientist Program, were present also.

Minutes of the November Executive Committee meeting and of the Annual Business Meeting were approved. The following reports were accepted.

The *Secretary* reported that 26 applications for membership had been received since the Annual Meeting and 14 names (including those of 3 deceased) had been dropped from the membership list. The total of regular members now is 983.

The *Secretary* read a letter from James B. Delano, chairman of the Engineering Section, in which he pointed out some problems concerning the Engineering Section and suggested possible solutions to some of them.

The *Treasurer* presented a report regarding the financial condition of the Academy as indicated by the records left by the late William G. Downs, Jr., Treasurer for the year 1963. The Treasurer, who served as chairman of the Auditing Committee for 1963, presented the report for that committee.

The *Director of the Visiting Scientist Program* presented a report concerning the current program and plans for the future of the program. He stated that 144 visitations had been planned, 93 of which have been completed. He discussed some changes designed to improve future programs.

The *Chairman of the Science Talent Search Committee* presented a budget request which was discussed in detail. He presented also a list of the 1964 honors group.

The *Editor* stated that the April issue of the *Journal* was ready to go to the printer. He stated also that he had sufficient articles to fill the issues of the *Journal* for the current year (1964).

The *Director of the Reelfoot Lake Biological Station* mentioned that the State Game and Fish Commission had decided recently to permit limited netting of crappie from Reelfoot Lake because of a decrease in

size of the fish apparently due to overpopulation. Research supporting this change is included in the 1964 report of Reelfoot Lake Biological Station.

The *Sponsor of the Collegiate Division* reported that recently he had received a call from the NSF offices in Washington suggesting that the honorarium in the 1964-65 proposal be decreased, but that the travel allowance for speakers might be increased. In view of the suggested changes, the net amount requested remains the same. The sponsor said that before travel allowances can be distributed equitably, information concerning the time and place of regional meetings should be forwarded to him by the regional sponsors. He mentioned, too, that vouchers are submitted for funds which are not included within the scope or limits of the grant. The sponsor requested that a successor be named for him soon so that he might go to Washington when a meeting on the grants is called. The report of the state meeting of the Collegiate Division held in Chattanooga is included in the minutes of the November meeting.

The following motions were passed by the Executive Committee:

1. A new member of the Academy should receive the *Journal* for the remainder of the year and throughout the succeeding year if he joins after July 1 (his dues will be for the succeeding calendar year). If he joins before July 1 he should be sent the back issues of the *Journal* for that year (and his dues will be for the current calendar year).
2. The President be given power to act in replacing the sponsor of the Junior Academy.
3. The President be given power to act in replacing the sponsor of the Collegiate Division.
4. The President and those he selects work out a budget of extraordinary expenses.
5. The Programs for the fall meeting be sent by first class mail.
6. Those who attend Academy meetings at Academy expense be allowed six cents per mile and expenses.
7. The 1964 Annual Meeting start at noon Friday, November 27, and extend to noon Saturday, November 28.

The following motion was defeated: The Senior Academy may, as a general policy, finance junior high school science activities from its general funds.

The meeting adjourned at 12:30 PM, February 23, having reconvened at 9:00 AM.

*November Meeting, Memphis State University*

The Executive Committee of the Tennessee Academy of Science was called to order by President James W. Ward at 9:00 AM in room 105 of the Biology Building at Memphis State University on November 27, 1964. Members present were Henry C. Allison, Clinton L. Baker, Frank H. Barclay, Norman Campbell, Don

Caplenor, Gustave H. Lundberg, Gordon B. Pennebaker, Richard J. Raridon, James W. Ward, and James L. Wilson. Attending also were committee chairmen James L. Major and Roger Rusk. Also present were John H. Bailey, future sponsor of the Junior Academy, and Myron S. McCay, representing Robert Wilson, who was ill.

The minutes of the February Executive Committee meeting were approved as corrected.

The Secretary reported having received 58 applications for Academy membership, including the 26 reported at the February meeting. A motion was passed that the remaining 32 applicants be elected. A total of 63 names was removed from the membership list, including those of 10 members deceased. The active membership now stands at 966. The various membership categories were reviewed, along with dues and certificates for each. It was pointed out that certain categories were being used that were not in the Constitution. It was noted that the 1964 program contained errors which apparently have been carried over from year to year. The secretary reported to the American Association for the Advancement of Science (AAAS) that no progress had been made on writing a history of the Academy but that the project still was set up to be done as a M. A. thesis in the Vanderbilt History Department. It was pointed out that persons are still being elected as section officers who are not members of the Academy. One such officer failed to join last year although three letters were sent to him.

The Treasurer presented an interim report. Details concerning expenditures and income were discussed. The report was approved.

The Editor presented the following written report:

The four issues of Vol. 39 (1964) of the *Journal* contain 21 research articles of which 10 are in biology, 4 in chemistry, 3 in geology, 2 in medical science, and 1 each in bacteriology and biochemistry. Included also are abstracts of papers presented at the annual meeting of the Academy by members of the Senior and Collegiate divisions and of papers presented at the annual meeting of the Kentucky-Tennessee Branch of the American Society for Microbiology. Each issue contains news of Tennessee science. On hand are 6 papers which have been accepted for publication and 4 others have been submitted to a section editor for review.

I wish to express my sincere appreciation to the section editors for their invaluable assistance and their excellent work.

This preliminary report of the expenses and income of the *Journal* does not include the cost of printing the January issue, which is paid by the State. (A list of expenses and income by categories was given in the written report.)

The Editor read a letter from the President of Franklin Square Agency soliciting the handling of overseas subscriptions to the *Journal*, for which he asked 50% commission of the selling price. After a brief discussion, a motion was passed that the Academy charge foreign subscription agencies the regular subscription price for the *Journal*.

The Director of the Reelfoot Lake Biological Station reported that three people used the station this past summer and that the program is continuing as

usual. It was pointed out that the station is open only during June, July, and August.

The past and present Sponsors of the Collegiate Division presented the following written reports:

The State meeting of the Collegiate Division of the Tennessee Academy of Science was held Saturday, November 30, 1963, at the University of Chattanooga in Chattanooga, Tennessee, in conjunction with the seventy-third meeting of the Academy. Approximately fifty persons attended and thirteen papers were presented. Dr. David A. Shirley, chairman of the Department of Chemistry, University of Tennessee, was the guest lecturer. Dr. Shirley spoke on problems confronting students attending graduate school.

Grant funds unused by the State meeting were to be redistributed for use by regional meetings. In spite of a strong appeal by the state sponsor for information about the time and place of regional meetings, only the western region responded. Don P. Claypool, former sponsor.

The Collegiate Division of the Academy held regional meetings in the west and east regions during April, 1964. At the meeting at Memphis State University twenty-five papers were presented by students from four schools. The east regional meeting was held at Tusculum College and four papers were presented. Both regions had luncheons with invited speakers following the papers.

A committee meeting of the Collegiate Division was held at Tennessee Polytechnic Institute in May. It was attended by the regional sponsors, the state sponsor, and the collegiate officers. At that time the resignation of Dr. John Warren as sponsor for the middle region was announced. Dr. Warren had accepted a position outside the state. The new sponsor for the middle region is Dr. Robert E. Martin, professor of biology at Tennessee Polytechnic Institute. A proposal has been submitted to the National Science Foundation for continued financial support of the Collegiate Division activities for 1965-66. The amount of \$4309 has been requested. A copy of the proposal is included with this report. Richard J. Raridon, sponsor.

The Sponsor of the Tennessee Junior Academy of Science (Dr. Myron McCay reporting for Dr. Robert Wilson) presented the following summary report:

The 1963-64 program of the Tennessee Junior Academy of Science (TJAS) was designed to promote active interest in science training and research among qualified high school students. The program also endeavored to provide an opportunity for discussion and demonstration of special projects by exceptional students. From twelve regions, of approximately 8 counties each, students were selected from two age groups and in five subject areas. Over 500 schools supplied students to the various regional meetings. From this number 60 participants were selected to be representatives at the State Science Day Meeting. The judges at the State Science Day meeting selected the outstanding papers from five subject areas. In the Senior Division the author of the winning paper at the State Science Day meeting received the American Association for the Advancement of Science (AAAS) award and was selected to represent the TJAS at the annual AAAS National meeting. The subject area classifications in 1962-63 were (1) botany, (2) chemistry-geology, (3) physics-mathematics-astronomy, (4) zoology. In order that greater opportunities in 1963-64 might be offered, the subject-area divisions were increased to a total of five. The new subject-area classifications now include (1) plant biology, (2) chemistry-earth sciences, (3) animal biology, (4) physics-astronomy, (5) mathematics. In addition a revision of geographic regions provides for better representation in the active and adjacent Oak Ridge and Knoxville regions. In the twelfth region the Oak Ridge Institute of Nuclear Studies served as the sponsoring institution. With these organizational changes the NSF-sponsored portion of the

1963-64 program had 60 State Science Day participants from high-level senior high school programs throughout the State of Tennessee.

The Director of the Visiting Scientist Program presented copies of a progress report, copies of the program announcement and roster of visiting scientists for 1964-65, and a copy of the proposal for the 1965-66 program to be sent to NSF. The details of each were discussed.

A motion was passed that the Executive Committee express a vote of appreciation and commendation to Professor Rusk and that the Academy provide \$1,000 to support the Visiting Scientist Program for 1965-66. A motion was passed that the Academy provide a maximum of \$300 to the Visiting Scientist Program for 1964-65 provided no funds are returned to NSF.

A motion was passed that the following written report of the Chairman of the Budget Committee be accepted.

By letter of March 11, 1964, the President requested the undersigned to serve as chairman of a small committee to "investigate and make recommendations on how best to spend funds available to the Academy" and to "make suggestions concerning the permanent installation of a budget committee." Dr. Arlo Smith and Dr. G. B. Pennebaker were asked to serve on this committee.

This committee met with Dr. Ward, Dr. Wilson, Dr. Lundberg, and Prof. Allison on May 16, 1964, to discuss various budgetary problems. Notes were kept by Dr. Wilson, the Academy secretary. His notes read in part: "Professor Campbell brought up some problems that would need answers before the committee could come up with a budget or with recommendations for constructing a budget. The first problem was that of the time the budget should be prepared. It was felt that the new officers, elected in November, should work up a budget by January which could then be submitted at the February Executive Committee meeting. Those people concerned should submit requests to be included in the budget at the November meeting. It was felt that the budget should be formalized by a budget committee made up of members of the Executive Committee. Academy accounts for the past two years were discussed as to income and expenses. Problems relating to indirect costs from grants and the grant-in-aid from the Tennessee Department of Education were also discussed. The item referred to as the Treasurer's account is to be cut from \$1,000 to \$600 and the \$600 is to include the secretarial and clerical help of the treasurer.

From further notes kept by the undersigned, the following comments may be made: additional sources of income are badly needed; commitments from the State Department of Education need to be secured earlier; the Academy needs to consider certain questions relating to its surplus, such as how large and for what purposes should a surplus be maintained; the Academy needs to consider the question of which programs to trim if trimming is necessary; the Executive Committee is, in effect, the budget-setting body; the President should have the privilege at his pleasure of setting up sub-committees to work on aspects of the budget if he feels such is desirable. Norman Campbell.

The President announced that Dr. John Bailey has been appointed sponsor of the Junior Academy beginning with the 1965-66 NSF grant period. Dr. Bailey, with the assistance of Drs. Wilson and McCay, has submitted a proposal for NSF funds. Dr. Robert Wilson

has agreed to serve during the remainder of the present grant period.

Mr. James L. Major (with Dr. Jewell serving on the Committee) presented the following Legislative Committee Report. The report was accepted.

In July the members of this committee and some other interested persons visited the Commissioner of Education, Howard Warf, to seek his aid in securing funds. Commissioner Warf secured a \$3,000 appropriation to assist in furthering the activities of the Academy, including those of the Junior Academy. At the meeting a suggestion was made that the legislature be asked to make a biennium appropriation to the Academy for such activities. On November 18 the committee and some interested members of the Tennessee legislature met at Vanderbilt. This group was unanimous in support of recommending that a specified sum be set up in the Tennessee Education budget for the needs of the Academy and Junior Academy. Procedures were set up to bring the recommendation and Academy activities to the attention of the Commissioner, and other interested personnel.

After a brief discussion concerning the location of the 1965 Academy meeting, a motion was passed that it be held in Oak Ridge at a date mutually agreeable to the Academy and the Oak Ridge National Laboratory.

The meeting adjourned at 12:00 noon.

#### THE SEVENTY-FOURTH MEETING OF THE TENNESSEE ACADEMY OF SCIENCE NOVEMBER 27-28, 1964, MEMPHIS STATE UNIVERSITY

The seventy-fourth meeting of the Tennessee Academy of Science was held November 27-28, 1964, at Memphis State University. Don Claypool was chairman of the Committee on Local Arrangements and Frank H. Barclay, East Tennessee State University, was program chairman.

One hundred-ninety persons registered for all sections of the Academy, including 89 members of the Senior Academy, 62 non-members, and 39 collegiate members. The General Session, with President James W. Ward presiding, was held in the auditorium of the Biology Building Friday afternoon. Three papers were presented. Conducted tours of the Memphis State University campus followed the General Session. The Annual Business Meeting was held at 4:30 PM Friday in room 105 of the Biology Building.

The Annual Dinner, attended by 95 persons, was held in the University Cafeteria at 7:00 PM Friday. Dr. Richard Stevenson, Graduate School dean of East Tennessee State University, spoke on "In Defense of a Dilemma".

Section meetings were held Saturday morning; 41 papers were presented at the Senior Academy meetings, 14 at the Collegiate Division meeting.

#### ANNUAL BUSINESS MEETING OF THE ACADEMY NOVEMBER 27, MEMPHIS STATE UNIVERSITY

The Business Meeting of the Academy was called to order in Room 105, Biology Building, at 4:30 PM by President James W. Ward. The minutes of the

Business Meeting of 1963, published in the Journal, and the minutes of the February Executive Committee meeting of 1964 were approved.

The Secretary reported that 58 applications for membership had been received and that 63 names have been removed from the membership list, which includes names of 10 deceased. The present membership is 966 compared to 971 at this time last year. A motion was passed that the 58 applicants be elected to membership in the Academy.

The Treasurer presented an interim report which was approved.

The President reported that Dr. Willard Jewell had resigned and Dr. Donald Caplenor agreed to serve out his term as a member-at-large on the Executive Committee. Dr. Don Claypool resigned and Dr. Richard Raridon was appointed sponsor of the Collegiate Division. Dr. Myron S. McCay resigned and Dr. Robert Wilson was appointed sponsor of the Junior Academy.

Reports of the Editor, the Director of the Reelfoot Lake Biological Station, the Sponsor of the Collegiate Division, and the Sponsor of the Junior Academy (Dr. Myron S. McCay reporting for Dr. Robert Wilson) were approved.

The Academy Conference and AAAS Representative for 1963, James L. Wilson, presented the following report:

Dr. Harry J. Bennett, secretary-treasurer of the Academy Conference, provided a copy of the minutes of the business meeting of the Academy Conference. At the Directors-of-Junior-Academies meeting, Dr. John D. Hopperton presented a final report on the Academy Conference Survey of Junior and Collegiate Academies, a copy of which may be obtained from Dr. Clinton L. Baker. The Academy Conference expressed strong approval of the general idea of the National Science Seminars as conducted at Albuquerque on May 6-11, 1963, and the AAAS will be urged to join with the Academy Conference in taking such steps as may be necessary to sponsor and promote such seminars on an annual basis.

The response to a request for a resumé of 1963 activities was very good. Dr. Bikle, chairman of the Standing Committee on Junior Academies reported that the papers presented at the second annual meeting were excellent and that they had been well received. He said also that the committee thought December 26 was not a proper time for the meeting, and it had been suggested the meeting be held in conjunction with the National Science Seminars. This meeting is to be designated as the American Junior Academy of Science Conference. The chairman of the History of Science Committee stated that 18 academies had responded to requests for their histories. Several histories have been published and some academies are to publish their histories in 1964. Dr. Garth discussed the relationship of the National Science Foundation (NSF) to academies. He stated that all programs will be continued under the new administration but that some programs will be stressed more than others. The financial support for academy programs for 1964 will be approximately the \$500,000 afforded for 1963, but Dr. Garth stressed that grants will be instituted with emphasis being given to training of undergraduates and teachers. During an afternoon symposium on the activities of the academies of science and the role of the NSF, Dr. Breukelman stated that the Kansas Academy organized the Junior Academy as a section in 1929. He pointed out that the Junior Academy had become much more effective as a result of NSF support

and discussed briefly the value of the Visiting Scientist program in Kansas. He discussed a new proposal submitted to NSF designed to acquaint college teachers with changes in high school curricula so that they might be more aware of the level of science training received by high school students. Dr. J. Teague Self stressed the many ways in which the Oklahoma Academy has utilized the financial assistance afforded it by NSF. He mentioned that special courses in such subjects as mathematics, electronics, and human genetics have been organized for several school systems, the classes taught by college professors paid through NSF grants. The first Distinguished Service Awards were presented at the 1962 banquet to Dr. Leland H. Taylor and Dr. Patrick H. Yancey. The recipients of the awards for 1963 were Dr. Clinton L. Baker and Dr. Wayne Taylor.

The AAAS Committee on Council Affairs highly commended the Study Committee on Natural Areas as Research Facilities, a 347-page report which has now been sent to each Council member who requested one. The chairman of the Committee on Science in the Promotion of Human Welfare discussed the paper entitled "Science and the Race Problem", which was prepared by the Committee and published in the November 1, 1963, issue of *Science*, and secondly, discussed the work of the Commission on Air Conservation, which expects to complete a major report in 1964. A review of the activities of the Committee on Public Understanding of Science included such activities as the Holiday Science Lectures, the AAAS-Westinghouse awards for excellence of science writing in newspapers and magazines, seminars that have been held for members of Congress and the congressional staff, the newsletter *Understanding*, and a series of television programs. Dr. Dael Wolfe reported that the major grant-supported activities of the year were the Traveling Science Libraries, studies of the qualifications of elementary science teachers, publication of a set of guidelines for the preparation in science of prospective elementary school teachers, publication of a volume on arid lands, a symposium on the sciences in Japan, the Holiday Science Lectures which will be increased to include 12 cities during this academic year, and the development of science teaching materials for kindergarten and the first three grades. A discussion was held concerning the ethical responsibilities of scientists. More than one study committee was in the process of studying the question and did not have complete reports to make. The Committee on Council Affairs was requested to accept responsibility for continuing the study. Due to the success of the AAAS symposia on Chinese and Japanese science, it was decided that the AAAS continue a series of symposia on the state of science in other countries.

The Chairman of the Fellows Committee presented the following report:

The following members of the Tennessee Academy of Science are nominated by the committee to be named Fellows of the Academy. Furthermore, those who are members of the AAAS are recommended also for nomination as Fellows in that organization.

Henry C. Allison, University of Tennessee, Martin  
Donald P. Claypool, Memphis State University, Memphis  
James B. Delano, Arnold Engineering Development Center, Tullahoma

Gordon E. Hunt, University of Tennessee, Knoxville  
Karl Z. Morgan, Oak Ridge National Laboratory, Oak Ridge

Mrs. Matthew M. Rayburn, Martin College, Pulaski  
E. Baylis Shanks, Vanderbilt University, Nashville  
Robert L. Wilson, University of Chattanooga, Chattanooga

John L. Wood, University of Tennessee, Memphis

A motion was passed that those named be made Fellows in the Academy and that the secretary determine

those who are not already Fellows in AAAS, but who are members therein, and report proper nominees to the AAAS secretary.

Letters were read by the Fellows Committee chairman from Miss Eleanor McGilliard and Wilbur K. Butts, who expressed appreciation for having been made Fellows of the Academy in 1963.

The *Necrology Committee* report (given by Dr. Clinton Baker) made note of the death of the following members:

Dr. Harry A. Allard	Mr. F. W. Hunnewell
Mr. Cecil B. Brown	Dr. Michael M. Marolla
Mr. Charles A. Browning	Miss Mary Bert Martin
Dr. Charles E. Diehl	Dr. George M. Rawlins, Jr.
Dr. William G. Downs, Jr.	Dr. Ray Womack
Dr. Ferris U. Foster	

A motion was passed to have the foregoing 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 reported that no applications for grants were made and no grants were awarded during 1964; hence the sum of \$269.00 will be carried forward.

The Chairman of the Resolutions Committee submitted the following report:

WHEREAS, The Tennessee Academy of Science, including the Collegiate Division, are enjoying a most pleasant, profitable, and well-organized series of meetings at Memphis State University, 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, Don P. Claypool, chairman, Dr. Carl D. Brown, Dr. A. S. Rudolph, members of the staff of the Department of Biology and members of the Biology Club of Memphis State University, from the recognition given the meetings by the 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 appreciation to these and all others who have contributed to the success of these meetings, and  
BE IT FURTHER RESOLVED, That these resolutions be spread 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. C. C. Humphreys, President of Memphis State University, and to Dr. Don P. Claypool, chairman of the Committee on Local Arrangements.

Respectfully submitted by the Resolutions Committee:

Seldon D. Feurt  
Robert B. Channell  
Richard Stevenson, Chairman.

A motion to approve the resolution and to send copies to Dr. C. C. Humphreys and Dr. Don P. Claypool was passed.

The Director of the Visiting Scientist Program reported that the present roster of 111 includes a panel of psychologists and an increased number of engineers and mathematicians. About 2300 copies of the roster were mailed to teachers and 140 invitations have been received, with only 10 of the 150 budgeted visitations left open.

The Chairman of the Science Talent Search Committee presented the following report:

Thirty-four winners in the 1964 Tennessee Science Talent Search were honored at Oak Ridge in April, 1964. The program was arranged by ORINS and financed by Union Carbide Corporation. Students were guests in the homes of Oak Ridge citizens. A full-day tour of the Nuclear Laboratories was provided by ORNL. Dr. Alvin M. Weinberg, Director of ORNL, and a member of the Tennessee Academy of Science, delivered the address at the banquet honoring the winners in the Science Talent Search and the finalists in the Junior Academy program. A questionnaire recently was sent to the winners in the 1964 Talent Search as well as to the winners in the previous ten years. A report is now being planned for the twentieth anniversary of the Tennessee Science Talent Search. A composite report on the present status of winners in the 1954-64 Tennessee Science Talent Search and an article which appeared in the October, 1964, issue of the *Tennessee Teacher* accompany this annual report.

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

President: Frank H. Barclay, East Tennessee State University  
President-Elect: Melburn R. Mayfield, Austin Peay State College  
Secretary: James L. Wilson, Belmont College  
Treasurer: Gordon B. Pennebaker, Tennessee Polytechnic Institute

There were no nominations from the floor, and a motion was passed that with the unanimous consent of the members present, the secretary be instructed to cast one ballot representing the unanimous vote of the members present.

The Annual Business Meeting adjourned at 5:40 PM.

#### GENERAL SESSION

Friday, November 27, 1:30 PM  
Auditorium, Biology Building  
James W. Ward, Chairman  
Vanderbilt University

*A Tabular Method for Objective Scoring.* John H. Honour, Elmhurst College, Elmhurst, Illinois.

Objective testing procedures are being used increasingly at secondary, college and university levels. The advantages of these procedures include question specificity, measurement objectivity, and factors related to increased student bodies and faculty work loads. A method is described for increasing objectivity in scoring of these tests in which answers are score weighted according to evoked responses. An ideal question is defined in terms of average difficulty, and is given more weight than very difficult questions which few or no students can answer, and also more weight than very easy questions which most or all of the students can answer. A statistical table of question weights has been developed which permits rapid scoring of answer sheets.

*An Experiment with Programmed Instruction.* James F. Key, University of Tennessee, Martin Branch.

Programmed instruction as a way of teaching, or supplementing teaching, has found wide acceptance in some quarters of the teaching profession. Most research dealing with this new method of teaching has sought to compare variations in the method with



conventional classroom instruction. One aspect which has had some investigation has involved the question of cueing, or test conditioning. In a recent experimental study conducted at Middle Tennessee State College, this particular problem was investigated using three groups of freshman mathematics students, who studied the topic of quadratic equations for a period of six weeks under controlled conditions. Results indicate that programed instruction may offer higher achievement scores purely from the standpoint of test awareness, i.e., cueing students to take the post tests.

*The Cooperative College-School Science Program at Austin Peay State College.* William G. Stokes, Austin Peay State College.

This paper discusses the aims and objectives of the National Science Foundation's Cooperative College-School Science Programs in general, and in particular the program conducted at Austin Peay State College for the past two years.

#### SECTION MEETINGS

Saturday, November 28, 9:00 AM

#### BOTANY SECTION

Room 105, Biology Building

James M. Moore, Chairman  
University of Tennessee, Martin Branch

*The Development of the Shoot Apex in Agave Sabra Salm-Dyck.* James M. Moore, University of Tennessee, Martin Branch.

By the time the emergent seedling is approximately  $\frac{1}{2}$  inch long the small mass of cells at one side of the primordium of the first leaf has developed to a point where the first signs of zonation are evident. As development of the first leaf gets under way definite zonation appears in the young apex at its base. After the second leaf is initiated the young apex appears as a small dome in median longitudinal section and consists of the following zones: a single surface layer, a corpus, a flank meristem, and a rib meristem. In older seedling a zone between the flank and rib meristems is gradually developed.

As development of the apex is observed in increasingly older plants it appears to broaden and flatten, and as periclinal divisions in the outer corpus become fewer additional surface layers are established which in the adult plant appear to vary from 5 to 6.

*An Experimental Garden—First Results.* H. R. Deselm, University of Tennessee.

Stools of Little Bluestem (*Andropogon scoparius* Michx.) and relatives, collected during the summers of 1962 and 1963 and spikelets collected in 1963, were planted in plots on the grounds of the University Agricultural Experiment Station at Knoxville. Growth from stools and seedlings reached heights at early anthesis inversely proportional to latitude of origin. Lateness of early anthesis was also inversely related to latitude of origin. Date of early anthesis of culms from seedlings was not so related.

*The Effects of Varying Temperatures and Light Intensities on the Growth Rates and Morphological Characteristics of Dictyosphaerium pulchellum Wood.* Harvey L. Ragsdale, University of Tennessee.

Growth rates and morphological characteristics of *Dictyosphaerium pulchellum* were observed from populations maintained at 20° and 25° under light intensities varying from 100 to 1200 ft-c. Growth rates, expressed as the number of times the population doubled per day, were 0.57 (100 ft-c) and 1.71 (1200 ft-c) at 20° C and 0.80 (100 ft-c) and 2.87 (1200 ft-c) at 25° C. Cell size varied between 3.0 and 7.0 microns among all treatments at 20° C and cell size increased with an increase in light intensity. Agitation of asexually reproducing populations resulted in up to 95% of a population occurring in a unicellular form. The percentage of uni-cells was highest in vigorously agitated test tube cultures. The rapid growth of *Dictyosphaerium pulchellum* in culture, unicellular populations, and certain aspects of the growth habit of *Dictyosphaerium pulchellum* indicate that it would be a valuable experimental tool.

*The Present Status of the Golden-aster Problem.* Paul L. Hollister, Professor Emeritus, Tennessee Polytechnic Institute.

Since the report to the Botany Section last year, field observations have been continued and intensified, especially between mid-August and September 15.

Three species have been found within twenty-five miles of Cookeville. One (*C. graminifolia* (Michx.) Ell. is rare; another (*C. Mariana* (L.) Ell. is common in open woods of the Cumberland Plateau; while the third (*C. camporum* ??) numbers in millions. Fifty miles from Cookeville or more this species, if present, is limited to isolated individuals or to widely separated populous patches. Most of the populous patches are spreading, but one near Oak Ridge seems to have become extinct.

Old fields, abandoned for several years, may contain the third species essentially in pure stand. This is strikingly so in the Center Hill Lake area. Here hundreds of plants, also, grow above, below, and in crevices of the Chattanooga shale. (This formation is radioactive and has been mapped by geologists of the U. S. Government.)

*C. camporum* (??), the "robust" populous species is believed by researchers at the University of Kansas to be a new one. (The curator at the New York Botanical Gardens disagrees at present.) Evidence favoring the new species is quite strong, viz:

- 1) The chromosome number, twice that of most species of the genus.
- 2) Its robustness, rugged and twice as tall as other species in this area.
- 3) Its reproductive potential, as shown by several heads and many viable seeds per plant.
- 4) Its growth pattern, basal offshoots with the formation of clumps instead of single stems.

*A Study of the Effect of Hexadecyl and Octadecyl*

*Alcohols on Transpiration in Phaseolus Vulgaris.* Neil A. Miller, Memphis State University.

The application of hexadecyl and octadecyl alcohols, their effect on the formation of a monomolecular film in the stomatal interfaces and its effect on transpiration were investigated. Molecules of hexadecyl and octadecyl alcohols have a chemical structure suitable for the formation of a superior monomolecular film. The hydroxyl group is attracted to the water molecules, and the methyl group forms the surface area. The surface tension of the monomolecular film will have the surface energy of the less active methyl group. The molecules tend to stand upright on the water surface and reduce the vapor-pressure gradient.

The rate of transpiration was measured by collecting the transpired water in a weighed tube containing sulfuric acid and through the use of a potometer. A ratio between the rate of transpiration and the leaf surface area and the plant dry weight was determined. Reduction of transpiration ranged from a mean of 24% with the potometer to 49.6% with the gas train. Radioautographs were made to show that hexadecanoyl was translocated throughout the leaf.

*A Study of the Major Plant Communities Occurring on Goose Island.* James W. Howell, Memphis State University.

This study consisted of a survey of Goose Island located in the Mississippi River near Memphis, Tennessee. Determining the major vegetational patterns, compiling a list of the more predominant fall plant species, and recording certain environment observations were the major objectives of the study.

It was found that the island could be conveniently divided into four ecological communities from which a total of 52 species were collected and identified. Observations were made indicating that the island is becoming more mesic.

#### CHEMISTRY SECTION

Room 209, Biology Building  
Richard J. Raridon, Chairman  
Oak Ridge National Laboratory

*Investigation of Possible Intermolecular Bonding in Some Mixtures of Phosphate Extractants by Use of Dielectric Measurements.\** W. J. McDowell and C. F. Coleman, Oak Ridge National Laboratory.

Dielectric measurements have been used as an aid in studying intermolecular bonding in mixtures of organophosphorous extraction reagents in *n*-octane.

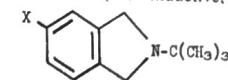
Dipole moments for several phosphate extractant species in *n*-octane were determined over a range of concentrations from about 0.005 to 0.5 *M*. Values at 0.03 *M* are: tri-*n*-butyl phosphate (TBP), 2.6D; di(2-ethylhexyl)phosphoric acid (HA)<sub>2</sub>, 2.5D; tri-*n*-octyl phosphine oxide (TOPO), 4.3D; the first sodium species extracted by di(2-ethylhexyl)phosphoric acid (NaA·3HA), 4.1D; the first strontium species extracted SrA<sub>2</sub>·4HA, 4.9D; and the normal strontium salt SrA<sub>2</sub>, 11.5D. Dielectric constants of mixtures of TOPO

with (HA)<sub>2</sub> and of TBP with (HA)<sub>2</sub>, NaA·3HA, and SrA<sub>2</sub> were measured as a function of composition at constant phosphorus molarity. The results indicate intermolecular bonding in all the mixtures except TBP-(HA)<sub>2</sub>.

\*Research sponsored by the U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.

*Synthesis and Study of N-t-Butylisindoline and Derivatives.* James H. Gardner and Robert F. Watson, Memphis State University.

The preparation of N-t-Butylisindoline and several of its 2- and 5- substituted derivatives are reported. Although the synthesis of these compounds is of certain intrinsic interest with regard to their probable physiological activity, the synthesis work was designed also to make available a system (I) suited to the study of electronic interactions (i.e. inductive, field and/or



(I)

homoconjugative) between remote groups within a molecule. The physical methods of study used, dissociation constant determination and ultraviolet spectra, indicate the existence of such interaction. On the basis of limited evidence the interactions are tentatively suggested to be inductive or field in nature rather than homoconjugative.

*Chemistry of the Recovery of Transplutonium Elements from Underground Nuclear Explosions in Rock Salt.\** W. D. Bond, Oak Ridge National Laboratory.

It has been proposed as part of the Plowshare Program that transplutonium elements be produced by irradiating targets with the very high neutron fluxes available during nuclear detonations. It is proposed to contain these explosions in deep salt deposits.

The transplutonium elements produced in an underground detonation in salt are dispersed to such an extent that the concentration is in the parts-per-billion range. The recovery of isotopes at this concentration presents unique problems. The process employed involves water leaching the debris to remove the salt leaving a water-insoluble residue. This residue has been found to contain >99% of the transplutonium isotopes and the fission product rare earths. The residue is leached with acid, bringing the transplutonium elements into solution. The transplutonium elements are concentrated by co-precipitation on a calcium oxalate precipitate. Further concentration is achieved by calcining the oxalate to the carbonate, dissolving the carbonate in nitric acid, and recovering the transplutonium elements along with the fission product rare earths by solvent extraction with tributyl phosphate. Separation from rare earths is accomplished by solvent extraction with tertiary amines from a concentrated lithium chloride solution. Finally, individual transplutonium elements are isolated by phosphonate extraction and ion exchange.

\*Research sponsored by the U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.



**Ion Exchange Properties of Yeast—Manganese Chelates.** Brother Edward Doody, Dr. Marion Garrett, and Sister Adrian Marie, Christian Brothers College and Siena College.

As part of a general program on the study of the effect of heavy metal ions and chelating agents on the yeast cell, *Saccharomyces cerevisiae*, we investigated the ion exchange properties of yeast with manganese (II) chelates. The ligands used were citrate, oxalate, malonate, succinate, fumarate and glutarate. The ability of the chelating agents to prevent "active" transport decreases in the order of citrate, oxalate, malonate and succinate. A direct relation was found to exist between the ability to prevent uptake of manganese (II) ion by the yeast and the size of the chelate ring formed. It was shown that the metal bound "irreversibly" to the yeast cell could be removed by chelating agents which form stable complexes, and the percent removed depended upon the concentration of ligand present. Equations have been derived and programmed for the IBM 1620 computer to determine the amount of metal ion bound irreversibly to the yeast cell.

**High Temperature Isopiestic Technique as a Research Tool.\*** P. B. Bien and B. A. Soldano, Oak Ridge National Laboratory.

The special feature of *in situ* weighings of sample containers without opening the system makes the high temperature isopiestic technique as developed by Soldano *et al.*<sup>(1)</sup> amenable to investigations of the water adsorbing characteristics of gels and membranes as well as the osmotic behavior of salt solutions.

The osmotic behavior of aqueous salt solutions at temperatures above 100°C has been extended to 165°C. At temperatures above 140°C the osmotic coefficient-molality curves show maxima in contrast to the minima observed at 25°C. The molality at which these maxima occur depend on the particular salt type. Osmotic coefficients are calculated from isopiestic ratios over wide ranges of temperature and concentration via an interpolation-extrapolation formula derived from the recently published primary standard data of Gardner *et al.*<sup>(2)</sup>

The water adsorbing characteristics of certain gels of interest as reactor fuel materials are being tested with this technique.

\*Research sponsored by U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.

<sup>1</sup>B. A. Soldano *et al.*, *The Structure of Electrolytic Solutions*, Dr. W. J. Hamer, Ed., pp. 224-235, John Wiley and Sons, New York, 1959.

<sup>2</sup>E. R. Gardner *et al.*, *Trans. Faraday Soc.* 59 (489), 1994 (1963).

**A Quantum Mechanical Study of the H<sup>+</sup><sub>3</sub> Molecule-Ion.** Maurice E. Schwartz and L. J. Schaad, Vanderbilt University.

The H<sup>+</sup><sub>3</sub> molecule-ion has been observed in the mass spectrometer, but there is no experimental evidence on its structure. In addition, it is the simplest electron deficient polyatomic. Thus a theoretical study

is of interest, and we have undertaken such a study using spherical Gaussian functions to construct approximate solutions to the molecular Schrödinger equation. The wavefunctions were constructed directly for the molecule, with no "atomic-like" functions being used. Each given wavefunction was completely optimized using an IBM 7072 computer.

In the equilibrium structure the three protons form an equilateral triangle of side about 0.88Å. The species is quite stable, having for our best wavefunction an energy some 80 k-cal/mole below the energy of a normal H<sub>2</sub> molecule and a proton. Further calculations are in progress. These will be discussed in detail, as will the molecular energy and implications about the bonding of the molecule.

**Activity Coefficients of Reference Solutes for Isoopiestic Measurements in Organic Solutions.\*** J. W. Roddy and C. F. Coleman, Oak Ridge National Laboratory.

With the renewed interest in the study of solvent extraction equilibria, there is increasing need for the activity coefficients of substances in the organic phase. Isoopiestic balancing of solvent vapor pressure between test solution and a reference solution is a particularly useful means for evaluating such activity coefficients, but its accuracy is limited to the accuracy of information about the reference solute. In contrast to the fund of activity data in aqueous solutions, very little information is available about activities in the organic solutions pertinent to solvent extraction.

To help fill this need, direct differential vapor pressure measurements are being used together with isopiestic cross-comparisons to measure the deviations from ideality of triphenylmethane and other reference solutes in organic solvents, especially in benzene and *n*-hexane. The deviations have been significant; e.g.,  $\gamma = 0.74$  at 0.330 *m* triphenylmethane in benzene. Some compounds of much higher solubility also appear promising as reference solutes in organic solutions.

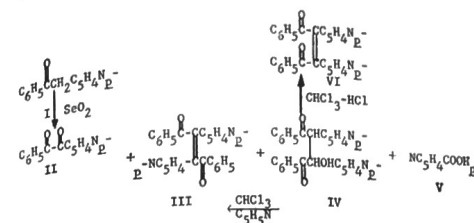
\*Research sponsored by the U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.

**Identification of the Oxidation Products of 1-Phenyl-2-(4-pyridyl)-ethanone-1.** C. A. Buehler and Roy E. Wells, University of Tennessee.

The oxidation of 1-phenyl-2-(4-pyridyl)-ethanone-1 (I) with selenium dioxide yields principally 1-phenyl-2-(4-pyridyl)-ethanedione-1,2(II), but there are obtained as well *trans*-1,4-diphenyl-2,3-di-(4-pyridyl)-2-butenedione-1,4(III), its aldol (IV) and isonicotinic acid (V).

Since the aldol IV may be converted into III, m.p. 247-249°, or VI, m.p. 196-196.5°, by dehydration, it appears that the *trans*-alkenedione III is formed via the aldol IV which in turn is produced by a condensation of I and II.

The two isomeric alkenediones, III and VI, as expected form the same lactone(1) and the same furan(2). Melting points, solubilities and infrared



spectra support the structures given. The UV and MMR spectra are being completed in order to assign the configurations with greater confidence.

(1) L. R. Kuhn, R. E. Lutz, and C. R. Bauer, *J. Am. Chem. Soc.*, 72, 5062 (1950).

(2) C. R. Bauer and R. E. Lutz, *J. Am. Chem. Soc.*, 75, 5997 (1953).

**The Sodium Fluoride-Scandium Fluoride System.\*** R. H. Karraker, Memphis State University, and R. E. Thoma, Reactor Chemistry Division, Oak Ridge National Laboratory.

In the investigation of cation size effects on the formation of complex fluoride compounds in molten salts, a study was made of the NaF-ScF<sub>3</sub> system. Prediction that the phase diagram of the system resembles that of NaF-AlF<sub>3</sub>\*\* was confirmed qualitatively. A preliminary phase diagram of the NaF-ScF<sub>3</sub> system was constructed on the basis of results from thermal analysis and thermal gradient quenching experiments. Two new compounds were observed and identified, using petrographic and x-ray diffraction techniques. NaF and ScF<sub>3</sub> form a congruently melting compound, 3NaF·ScF<sub>3</sub> (m.p. 850°C), and a compound of composition near NaF·ScF<sub>3</sub>, melting incongruently to ScF<sub>3</sub> and liquid at 660°C. Structural data are not yet available for NaF-ScF<sub>3</sub> compounds; the phase 3NaF·ScF<sub>3</sub> is, however, not isostructural with cryolite, 3NaF·AlF<sub>3</sub>. Three invariant reactions were observed in the NaF-ScF<sub>3</sub> system, two eutectics and one peritectic, at 17, 36, and 40.5 mole % ScF<sub>3</sub>, and at temperatures of 805, 655, and 660°C respectively.

\*Research sponsored by U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.

\*\*R. E. Thoma, *Inorg. Chem.* 1, 220 (1962).

#### MATHEMATICS SECTION

Room 301, Biology Building  
William G. Stokes, Chairman  
Austin Peay State College

**Pythagorean Triples.** Ronald Sircy, Tennessee Polytechnic Institute.

This paper will give a method for finding all pythagorean triples.

**Equivalence of Countable Bases.** Reginald Mazeres, Tennessee Polytechnic Institute.

This paper will prove that any two countable bases of order sets are equivalent.

**A Biased Estimation Technique.** James R. Thompson, Vanderbilt University.

GEOLOGY-GEOGRAPHY SECTION  
Room 233, Biology Building  
Robert W. Johnson, Jr., Chairman  
Tennessee Valley Authority

**Economic Aspects of the McNairy Formation in West Tennessee.** Robert E. Hershey, Tennessee Division of Geology.

The McNairy Formation is present in the subsurface in most of West Tennessee and is exposed in a narrow belt west of the Tennessee River extending from Mississippi to Kentucky.

This belt is near the eastern margin of the Mississippi Embayment. The formation was deposited in a shallow marine to shoreline environment. Sand is the predominant constituent, is usually fine- to very fine-grained, subangular, and contains varying amounts of iron oxide. Clay is present as thin interbeds and occasional lenses several acres in extent.

Economic uses of the formation include groundwater; sand for glass, grinding, foundry, and construction purposes. A past product was clay.

Undeveloped uses are the utilization of heavy mineral sands which are present as a source of titanium, and monazite, which contains thorium and some rare earths. Mica is present and a possible source of scrap mica. Minor amounts of high-alumina clays may be present.

**Preliminary Conclusions from a Regional Gravity Survey of the Wells Creek Basin Structure, Houston and Stewart Counties, Tennessee.** Richard G. Stearns and Phyllis S. Marsh, Vanderbilt University.

Origin of the Wells Creek Basin structure is in active dispute. Generally, it is thought to be either a cryptovolcanic structure or the result of meteor impact. A regional gravity map and two magnetic profiles were made as part of a National Aeronautics and Space Administration-supported study of this problem.

From the gravity and magnetic data we can state that: (1) no dense mass, such as a metallic or stony meteorite, lies beneath or beside the structure; (2) no dense volcanic body intrudes to shallow depth; (3) no large dense mass directly underlies the structure, even at basement depth.

Anomalies accompanying the structure are those expected from surface geology. A positive 2½-milligal anomaly centers over dense Knox dolomite in the topographic basin floor, but no anomaly marks either the outer edge of the topographic basin (2 miles across) or the structure (10 miles across). The structure is not centered on any regional anomaly, but is symmetrically located on a gravity nose extending north from an east-west trending regional gravity high.

The main facts tend to support the meteor impact hypothesis; but the symmetrical location with respect to the regional gravity pattern keeps open the possibility that the Wells Creek Basin structure is a cryptovolcanic feature located over a deep-seated fracture zone.

*Origin of the Clastic Dikes in the Porters Creek Clay at Pinson, Tennessee.* D. J. Nyman, U. S. Geological Survey.

The Pinson clastic dikes are discordant bodies of mostly fine, micaceous, brownish sand which probably represent a composite of materials from the Clayton and Ripley Formations (both artesian aquifers) and the Porters Creek Clay. The water-saturated clastic materials under forces of artesian pressure and static load, were initially injected into fractures, such as minor faults. The principal dike, however, which is 15 feet in width may require an additional geologic process to account for its large size. Cavities have been found in West Tennessee which range in depth from 60 to 550 feet below land surface. Possibly a cavity formed in a minor dike and additional clastic material were injected filling the cavity. The formation of cavities may be the result of tension caused during downwarping of the Mississippi embayment syncline and the consequent stretching of the unconsolidated sediments. The dikes are post-Paleocene in age.

*Involvement of the Tuscaloosa Formation (Upper Cretaceous) in Normal Faulting in Franklin, Marion, and Winston Counties, Alabama.* Ray G. Martin, Jr., Tennessee Valley Authority and the University of Tennessee.

Recent field work, by the author, in Franklin, Marion, and Winston Counties, Alabama, has shown the Tuscaloosa formation, Upper Cretaceous, to be involved in the faulting of a structural dome north of Haleyville, Winston County, Alabama.

The Tuscaloosa formation in this area consists of coarse gravels, coarse to fine sands, and clays lying unconformably on Pennsylvanian rocks. The formation exhibits a gentle westerly regional dip.

Structurally, this area is a faulted dome displaying both normal (tensional) and reverse (compressional) faults. It is felt that these faults are tensional and compressional features related to structural downwarping in the Mississippi embayment during Tuscaloosa deposition.

Tuscaloosa outcrop data indicate that younger portions of the formation have been displaced relative to lower units and have been preserved on the downthrow side of a major normal fault having a maximum of 155 feet of a stratigraphic displacement.

*Compilation of a Gravity Map for Tennessee.* Robert W. Johnson, Jr., Tennessee Valley Authority.

Compilation of a gravity map for Tennessee is now under consideration. Preliminary studies indicate that confirmation of basic data will be advantageous to insure accurate location of stations and proper Bouguer anomaly values. Present plans include publication of a provisional gravity map at the scale of 1:500,000 and initiation of a continuing program to establish additional gravity stations as necessary to acquire better knowledge of several areas characterized by complex gravity anomaly patterns. Basic data to be

used in the initial compilation were assembled from various sources and reduced by electronic computer by personnel at the Department of Geology, University of Wisconsin, under the guidance of G. P. Wollard.

#### MEDICAL SCIENCES SECTION

Room 323, Biology Building

John B. Thomison, Chairman

Vanderbilt University School of Medicine

*The Glyoxylate Cycle and Cellulose Synthesis in Acanthamoeba sp.* Dr. Gus Tomlinson, George Peabody College.

Incorporation *in vivo* of acetate-C-14 and glyoxylate-C-14 into cellulose of the cyst wall of *Acanthamoeba* sp. gave rise to the hypothesis that a net conversion of lipid carbon to cellulose was occurring via the glyoxylate cycle during encystment. In order to investigate this possibility, particle-free extracts were prepared for assay by centrifuging cell homogenates at 170,000 X g. Key glyoxylate cycle enzymes *viz.*, isocitratase and malate synthetase were assayed by the methods of Dixon and Kornberg (1959). The same cell-free extracts were assayed for UDPG-pyrophosphorylase activity by the method of Ginsberg (1958). Since an assay for UDPG-Cellulose transglucosylase had not been reported, a new assay based on the incorporation of glucose-C-14 into cellulose *in vitro* was devised. The presence of isocitratase, malate synthetase, UDPG pyrophosphorylase, and UDPG-Cellulose transglucosylase in extracts of *Acanthamoeba* was demonstrated. Activity curves for all four enzymes were prepared. Thus, the presence of the necessary enzymes for a functional glyoxylate cycle and for synthesis of cellulose from hexose phosphate has been demonstrated in this soil amoeba.

Dixon, G. H. and Kornberg, H. L., Enzymatic assay of Isocitratase *Biochem. J.*, 72 3-4 (1959).

Ginsberg, V., Purification of UDPG pyrophosphorylase from mung bean seedlings. *J. Biol. Chem.*, 232 56-61 (1958).

*Fine Structure in Frozen-Etched Soil Amoeba.* G. Tomlinson\* and K. Muhlethaler, Swiss Federal Institute.

Encystment in *Acanthamoeba* sp. constitutes a differentiation (Tomlinson, 1962; Trager, 1963). The ultrastructural changes which occur during differentiation in this soil amoeba have been investigated by electron microscopy using the newly developed freeze-etching technique plus the classical techniques of sectioning chemically fixed material. In addition to gross structural changes which occur during formation of cyst wall, ultrastructural changes also have been demonstrated in the nucleus, nucleolus, ground cytoplasm and plasma membrane. Such changes have been followed through progressively later stages in the encystment process. A correlation in time between the onset of induced enzyme synthesis which was demonstrated biochemically and *de novo* appearance of 80 Å particles on the plasma membrane was demonstrated.

These events, in turn, correlate with the onset of cellulose synthesis during the formation of the cyst wall.

\*Present address, George Peabody College.

Tomlinson, G., "Mechanism of Cyst Wall Formation in *Acanthamoeba* sp.," Vanderbilt University (Thesis) Aug. (1962).

Trager, W., Differentiation in Protozoa. *J. Protozool.* 10 (1) 1-6 (1963).

*Hormone Influence on Hepatic Amino Acid Transport.* Ralph Georg and John Chambers, Vanderbilt University School of Medicine.

Insulin, hydrocortisone (HC), and glucagon, are three hormones which have been demonstrated to increase amino acid transport in the liver. These hormones also modify amino acid utilization in that organ. Insulin increases amino acid incorporation into protein. HC increases the utilization of amino acids in protein synthesis and gluconeogenesis while glucagon stimulates amino acid destruction for gluconeogenesis-urea formation.

It has been suggested that perhaps the increased hepatic amino acid uptake seen with these hormones is secondary to their effect on intracellular utilization of amino acids. However, all three hormones increase the uptake of aminoisobutyric acid (AIB), an amino acid analog which is concentrated but not metabolized by the liver. Also significant stimulation of amino acid transport by both insulin and HC occurs following the inhibition of protein synthesis by Actinomycin D.

Interestingly, phenoxybenzamine, an adrenergic blocker had no effect on insulin action to increase amino acid transport but completely blocked HC's stimulation of hepatic AIB uptake.

This data suggests that the mode of action of hydrocortisone is different from that of insulin.

*The Effect of Estrogens on Hepatic Lipid Transport.\** Mary Louise Watkins and Murray Heimberg, Vanderbilt University School of Medicine.

The mechanisms by which the female gonadal hormones produce their effect on lipid metabolism are not well understood. In the rat these effects include increased fat synthesis, greater content of fat in the carcass, increased serum cholesterol, triglyceride and phospholipid, and altered cholesterol/phospholipid ratios.

It is possible that the action of estrogens may be dependent on the presence of intact cellular structure. This structural integrity is absent in many preparations, but is one of the major advantages of the isolated perfused liver.

We have found that livers from normal fed female rats perfused in an isolated system *in vitro* released more triglyceride (TG) into the perfusate than did livers from normal male rats. When palmitic acid was added to the perfusate as a substrate net release of TG by the liver was increased in both sexes. TG release by livers from female rats ovariectomized 4 to 6 weeks before the livers were removed decreased markedly from the level shown by the normal female. When the ovariectomized (ovx) female rats were pretreated with

200 µg polyestradiol phosphate (PEP) one week prior to sacrifice, the net TG release was returned to the level of the livers from normal fed females; when PEP was infused into the perfusate at a constant rate of .33 µg/cc/min., the net TG release by livers from ovx females was returned to the level of the normal female.

Glucose production did not differ among the normal male, normal female, ovx female, ovx female+estrogen administered *in vivo*, and ovx female+estrogen *in vitro*; nor did production of urea differ in these groups.

Future experiments will be directed toward determining whether the increase in TG release observed on administration of estrogen might be due to an increased rate of uptake of fatty acids, increased esterification of fatty acid to triglyceride, or increased lipoprotein synthesis.

\*Supported by grants-in-aid from the National Institutes of Health and the American Heart Association.

*Responses Elicited From Orbital Cortex of Cats: Overt Activity and Related Pathways.\** James B. Back and James W. Ward, Vanderbilt University School of Medicine.

Electrical stimulation of the cortex adjacent to the presylvian sulcus in unanesthetized cats through implanted electrodes yields inhibition of walking but not of tone or other activities. Alerting appears to be the common denominator for elicited responses which include alteration in respiration, sniffing, licking, chewing, staring, skin hypersensitivity, alerting, tail wagging, and the like. Results suggest that this cortical area functions in part in elaboration of alerting and/or protective behavior initiated by a wide variety of sensory modalities (more than the "oral senses"). Olfactory bulb stimulation did not yield the alerting pattern. Pathways were traced by evoked potentials from the fixed points of the known "function" described above. Localized activity initiated through different fixed electrodes was recorded in the internal capsule, basis pedunculi, pyramid, substantia nigra, reticular formation of mesencephalon and medulla, caudate nucleus, thalamus except anterior nucleus, hypothalamus except mammillary bodies, anterior sylvian and ectosylvian gyri, cingulate gyrus, and the cerebellum. Projection via internal capsule to the reticular formation seems to be the most likely route for inhibition.

\*This investigation was supported in part by Public Health Service Research Grant NB 01954 from the National Institute of Neurological Diseases and Blindness.

*Postheparin Plasma Lipase from the Hepatic Circulation of Dogs and Rabbits.* Robert L. Hamilton, Jr., Vanderbilt University School of Medicine.

Rapid disappearance of alimentary triglyceridemia and immediate appearance of Clearing Factor Lipase (CFL) in the circulation are known responses to intravascular heparin injection. The swiftness of these responses led to the attractive hypothesis of CFL's endothelial location and function in particulate fat removal from the blood. Generally, the richest sources of CFL are those tissues active in triglyceride uptake.

The liver, however, has been considered an important exception since little or no CFL had been found previously although hepatic tissue plays a dominant role in particulate fat transport.

The present study demonstrates that heparin displaced CFL into the blood stream during a single passage across the hepatic circulation. Functional hepatectomy implicated the liver as a major contributor to the total circulating lipolytic activity 5-10 minutes postheparin. Hepatic postheparin plasma lipase proved quite similar but not the same as circulating lipase demonstrating heterogeneity of CFL. The observations will be considered briefly in relation to clylomicon uptake by the liver.

#### PHYSICS-ASTRONOMY SECTION

Room 304, Biology Building  
Brother George Carney, Chairman  
Christian Brothers College

*ORINS Radioisotope Mobile Laboratory.* Joseph Ontko, University of Tennessee Medical Units.

*Conference on Undergraduate Research in Physical Optics.* Fritz R. Stauffer, Southwestern at Memphis.

*Preparation of Ultra Pure Calcium Carbonate from Electromagnetically Separated  $^{48}\text{Ca}$  for Calcium Fluoride Crystal Growth.\** J. O. Younghans, R. L. Bailey, H. R. Gwinn, Oak Ridge National Laboratory.

This paper discusses purification of  $^{48}\text{Ca}$  to remove alpha emitting contamination to  $<0.5$  ppb to permit use of the enriched material in double beta decay studies.

\*Research sponsored by the U. S. Atomic Energy Commission under contract with Union Carbide Corporation.

*The Conversion of a Calutron into a  $180^\circ$  Sector Separator with 0.8 Inhomogeneity.* T. W. Whitehead, W. K. Dagenhart, W. A. Bell, Jr., L. O. Love, Oak Ridge National Laboratory.

The electromagnetic process of isotope separations in the ORNL calutron will be discussed. The problems associated with the conversion of a calutron into a sector separator and the utility of such a machine for making heavy mass separations will be considered. An explanation of the theoretical methods used to determine the imaging characteristics of the 0.8 sector lens and the description of a numerical method used to determine magnetic shim contours will be included.

*Determination of Rest Mass of Pion and Muon Particles as a Laboratory Experiment.* Brother George Carney, Christian Brothers College.

An experiment in which the student can measure the rest mass of the above elementary particles can be performed quite simply with several 35mm slides even though only one stereoscopic view is used. Eight bubble chamber slides are projected on a screen and two basic measurements are made on each slide. Measurements of about 30 positron radii and muon path length will give an accuracy to about 3% for the rest

masses. An equation is presented which corrects for foreshortening of the paths on the screen. A simple radii template is used to measure positron radii. Equations used in calculation of the rest masses are presented. The strength of the magnetic field used with the bubble chamber is needed together with the density of the medium in the bubble chamber. Slides are reasonably easy to obtain.

#### ZOOLOGY SECTION

Room 131, Biology Building  
John M. Mallette, Chairman  
Tennessee A. and I. State University

*Some Insects Collected from Sugar Beets Grown on West Tennessee Upland Soils.* George Horton and Elmer W. Counce, The University of Tennessee, Martin Branch.

As early as 1962 considerable interest was shown by businessmen and farmers in sugar beet production in Dyer County, Tennessee, and surrounding areas. In 1963 plots were grown by a few farmers in the Dyer County area. Results from some of these plots led the Agricultural Experiment Station Staff of the University of Tennessee to seek additional information. Hence, feasibility study plots were initiated in Upland Soils at the University of Tennessee, Martin Branch, in February, 1964, in which fifteen varieties are being grown.

Since the sugar beet is a plant new to this area, the question arises as to what part insects may have in the successful production of the crop. Insects were observed on the plants and collected at intervals. Damage was noted from time to time and control measures were carried out several times during the summer. A large number of species were collected, many of which were beneficial. Further detailed studies on insect population are planned for the next growing season.

*The Retention of Cholesterol When Fed and Injected into Adult Swiss Albino Male Mice.* Ivan R. Davis and John M. Mallette, Tennessee Agricultural and Industrial State University.

Adult male mice were divided into four groups, two experimental and two control groups. The first experimental group was injected with 35 mg of cholesterol suspended in 1 cc of Hank's physiological solution. The second experimental group was fed a mixed food containing 35 mg of cholesterol blended with 3.5 g of normal diet food for a 24-hr. period.

The first control group was injected with 1 cc of Hank's physiological solution. The second control group was fed 3.5 g of normal diet food for a 24-hr. period.

After 26 days all mice were given cholesterol tests using the procedure in the Bausch and Lomb spectrometer 20 laboratory manual. The following results were obtained: In the first experimental group the retention of cholesterol was 36%. In the second experimental group the retention of cholesterol was 95%.

In the first control group the concentration of cholesterol was lower but differed only by 1.27 mg as compared to the experimental injected group. In the second control group the concentration of cholesterol was lower and differed by 24.50 mg as compared to the experimental fed group.

*Some Effects of Proteins Isolated Zoology from Mice Salivary Glands on the Esophageal Epithelium of 11-Day Chick Embryos.* J. M. Mallette, W. T. Briggs, and S. Cohen,\* Tennessee Agricultural and Industrial State University.

In Vitro and In Vivo studies were performed on proteins isolated from mice salivary glands on the esophageal epithelium of 11-day chick embryos. Seventy-five per cent of the tissue cultures showed a significant enhancement of epithelial differentiation on the 11-day chick esophagus. Approximately 2-3 mm of the 11-day chick esophagus were cultured aseptically in a synthetic medium (Eagle's basal medium) for 48 hours, fixed in Bouin's solution, and embedded by standard procedures. Sections were made at 7 micra and stained with hematoxylin and eosin. Experimental results indicated that the tunica propria appeared to be obliterated. Approximately  $5.7 \times 10^{-3}$  mg of the isolated proteins were sufficient to demonstrate a biological effect.

\*Department of Biochemistry, Vanderbilt University.

*Toxicity Studies of Aspirin, Caffein, and Acetophentidine on the Developing Embryo.\** J. M. Mallette, T. O. Brown and J. E. West, Tennessee Agricultural and Industrial State University.

Some effects of caffeine, acetophentidine, and aspirin were studied on chick embryos following injection of the compound prior to and during incubation. Fertile eggs were injected with the solvent of each compound and uninjected eggs were used as controls.

Two criteria for determining embryonic response to the compounds were employed; (1) mortality rate and (2) types and incidences of malformations. Eighty-five percent of the embryos injected with caffeine died. Abnormalities found in the chick embryos were: twisted beaks, stubby limbs, malformed eyes, and in some instances no eyes were developed.

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*Sublethal and Lethal Concentrations of Some Pesticides to Developing Chick Embryos.* O. L. Adams and E. J. Thornton, Tennessee Agricultural and Industrial State University.

Experiments were conducted to determine both lethal and sublethal concentrations of some pesticides for developing chick embryos. The pesticide solutions were injected into the albumin of the eggs through an opening in the shell over the air cell. The openings in the shells were sealed with Duco cement. The eggs were incubated in a Petersime incubator.

Concentrations of 2.3 ppm (parts per million) of lindane; 6.54 ppm of dieldrin; 6.0 ppm of aldrin; 2.1

ppm of benzene hexachloride (BHC); 5.92 ppm of malathion; and 5.0 ppm of dichloro-diphenyl-trichloro-ethane (DDT) were lethal to developing chick embryos under the conditions of this experiment.

Lower concentrations of the same pesticides were sublethal with hatchabilities ranging from 1 to 90 percent.

The results of these experiments indicate that lower concentrations of certain pesticides are probably detoxified within the embryos or in the extra embryonic area by other substances found in the egg or produced by the embryos.

*Status of the Bait Minnow in Tennessee, 1963-64.* Ray Hoffarth and John Conder, Tennessee Game and Fish Commission.

Seventy-eight minnow dealers were contacted by personal interview including 39 hatchery operators, 33 wholesalers, and 6 retailers. The current trend is toward importation of minnows from other states, where they are available at lower production costs. Today's popular size minnow retails for 35¢ per dozen as compared to 55¢ per dozen in 1952. Total minnow sales increased from 52,734,505 in 1952 to 77,606,858 in 1964. In most cases, diseases, are being controlled effectively. Aquatic weeds are a continuous problem in Tennessee hatcheries. A study should be conducted to evaluate the effect of the Stickleback on present fish populations in Tennessee.

*The Cicindelidae of Shelby County, Tennessee.* J. F. Payne, Memphis State University.

A taxonomic study was conducted from June, 1963, to June, 1964, to determine the species of the Family Cicindelidae in Shelby County, Tennessee. Collection trips were made to many favorable habitats in the county. The insect collection of the Memphis State University and personal collections gave supplementary information.

A total of 14 species resulted from the study. Almost all habitats sampled proved productive for tiger beetles and these habitats ranged from the sand bars of the Mississippi River to the open woodland paths in Shelby Forest. This study is planned as the first step in the eventual compilation of a complete check list for West Tennessee.

#### SCIENCE-MATHEMATICS TEACHERS SECTION

Room 322, Biology Building  
Frances B. Wild, Chairman  
White Station High School, Memphis

*The High School Student and Research—A Critical Look and an Evaluation.* Panel Discussion with panelists Mr. George Robertson, Dr. W. E. Jefferon, Jr., Mr. J. D. Reding, and Dr. M. S. McCay.

*Changes in the Science and Mathematics Curriculum in the Last Decade—Purposes, Aims and Results.* Mr. John Pachonic, Mr. W. T. Conn, and Mrs. Evelyn Scrimger.