Reports of Sections and Societies

Mathematics (A)

Education was a major concern in two programs of Section A. John Kemeny reported on the recommendations of the Panel on Mathematics for the Biological, Management, and Social Sciences of the Committee on the Undergraduate Program in Mathematics. A relaxed and thoughtful discussion of his talk centered on the problems of implementation. Confirmation of the need for appropriate mathematical education for students in biology and medicine was given by Theodore D. Sterling who cited examples of misuse of statistical inference and lack of knowledge of computer capabilities. The social science area was to have been represented by Paul Lazarsfeld, but he was unable to attend. Computing as a separate discipline and as related to undergraduate education were the concerns of Saul Gorn and A. J. Perlis in their addresses under the sponsorship of the Association for Computing Machinery.

Three aspects of communication mathematics were treated by Robert Fano (coding techniques), Paul E. Green (statistical estimation), and Dean Gillette (antenna design for the Telstar satellite) in a program sponsored by the Society for Industrial and Applied Mathematics.

The vice-presidential address by Magnus R. Hestenes on variational theory and optimal control problems was a technical report on research of the speaker.

WALLACE GIVENS, *Secretary*

Physics (B)

Physicists were given a richer fare than usual at the AAAS Cleveland meeting. While the regular Section B program comprised only the Physicists' Luncheon and an afternoon session of invited papers, there were several other sessions during the meeting that were of special interest to physicists. Outstanding was the paper by A. L. Schawlow on infrared and optical masers, presented in the "Moving Frontiers of Science" series, and the morning session on AAAS Day with four papers on the uses of lasers and masers, which included combination instruments employing fiber optics. Also of interest to physicists were the symposia on degenerate stars and on meteorites (arranged by the section on Astronomy) and some of the programs on the history and philosophy of science.

The four invited papers on contemporary physics were drawn from the Case Institute of Technology and Western Reserve University, and gave a clear indication that a vigorous attack on some of the frontiers of research in classical and modern physics is being made at these two Cleveland institutions. Frederick Reines (Case), the co-discoverer in 1956 of the free neutrino, gave a most informative description of the brief history and current status of neutrino physics. This particle, possessing no electric charge or rest mass, and sometimes referred to as "nothing spinning," has now been shown to exist in four different forms: two neutrinos of different origin and the corresponding anti-neutrinos. Thus it has been suggested that there may be a parent particle, called the W meson, which can decay into the two basic types of neutrinos. Because of its very weak interaction with matter the neutrino was exceedingly difficult to detect. Conversely, since it can go for distances of many light years without interacting with another particle or an atomic nucleus, the subject of neutrino astronomy is being vigorously discussed as a new tool to reveal the secrets of the far reaches of the universe.

The other paper from Case, by Robert S. Shankland, dealt with the classical subject of acoustics and was entitled "Rooms for speech and music." In comparison with the situation in optics, one could say that *geometrical* acoustics falls short of giving the proper answers on the wave characteristics of sound fields, so that *physical* acoustics must be invoked along with the familiar concepts of diffraction, interference, scattering, and diffusion. Illustrations were given as to how these more modern techniques combine with psychological factors to reveal the proper acoustical properties of auditoria and concert halls.

The two papers from Western Reserve were presented by B. S. Chandrasekhar and Joseph W. Weinberg. The former was concerned with recent developments in high-field superconductors, especially the welcome possibility of obtaining very intense magnetic fields by the use of superconducting magnets that employ newly developed materials whose superconductivity persists to fields as high as 200 kilogauss. The second touched on a problem of growing interest in stellar astrophysics, namely, the unique process in certain stars—supernovas and other "super stars"—that causes them to radiate so brilliantly. It was suggested that the general relativistic theory of gravitation is involved in this catastrophic process in the interplay between increasing pressure gradient and gravitational potential energy and results in the release of unprecedented amounts of energy. The audience of this session numbered over 150 and included many students and local scientists.

At the Physicists' Luncheon, attended by about 50, Elmer Hutchisson, retiring vice president for the Physics section, described some of the modern day problems arising in communication, not among scientists with widely diverging interests, but within as close-knit a group as physicists themselves. He suggested that scientific periodicals have proliferated to the extent where some new method of information retrieval must be introduced to aid a specialist in discovering and obtaining copies of the papers of primary interest to him. Honorary membership in Sigma Pi Sigma, joint sponsor of the luncheon, was conferred upon Robert S. Shankland.

STANLEY S. BALLARD, *Secretary*

Chemistry (C)

A sympsoium dealing with "Chemistry of radical-ions" was held on 28 December. W. F. Libby discussed some of the chemistry of the methane radical cation, $CH_4^{+\cdot}$, generated by ejection

of an electron from methane by ionizing radiation. The chemistry of this transient species may be understood in terms of its similarity to the isoelectronic fluorine atom. The charge on the radical species leads to energy enhancement and polarization attraction. Introduction of alkanes into a mass spectrometer generates cations of the type CH_5^+ and $C_2H_7^+$ (M. Munson, J. L. Franklin, and F. H. Field). In studies on the effect of bases in interrupting polymerization of dienes catalyzed by radical-ions, T. F. Williams pointed out that radical-cations may be regarded as protonated radicals. The transfer of an electron from a donor, such as sodium, to an aromatic olefin gives a relatively stable radical-anion. The use of such species in polymerization reactions (M. Swarc), in new synthetic approaches (D. Lipkin), and the magnetic properties of such species (S. Weissman) were described. The generation of radical cations on solid catalysts (H. Leftin) can be followed spectrophotometrically.

The second symposium, dealing with the "Chemistry of the excited state," was held on 30 December. G. Porter (University of Sheffield), the keynote speaker, demonstrated with the use of an ingenious plastic model the $\sigma \rightarrow \sigma^*$, $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ singlet and triplet transitions in formaldehyde. He stressed the contributions arising from the newer techniques of studying the excited state, namely, matrix stabilization and flash photolysis. These techniques permit decisions as to whether reaction mechanisms involve singlet or triplet states. Traditional chemistry is ground state chemistry, but there is a vast chemistry of the excited state which is just now beginning to unfold. The phenomenon of delayed fluorescene was discussed by S. P. McGlynn and T. Azumi, and on the basis of new evidence this two-photon process was ascribed to triplet-triplet annihilation. Evidence was presented (W. Bartok and P. J. Luchessi) showing that the acid strength of phenols is about a million times greater in the excited state than in the ground state. Substituent effects have approximately the same influence on acidity in both states. The photochemistry of carbonyl compounds (N. C. Yang) is characterized by intramolecular cyclizations resulting from hydrogen abstraction by the positive oxygen generated by excitation. The role of photosensitizers in the *cis-trans* isomerization of stilbene was considered (J. Saltiel and G. Hammond). The photostationary ratio of isomers depends on the triplet energy of the sensitizer. The symposium closed with a spirited discussion of this last paper.

The two symposia were characterized by unusual enthusiasm and excellent attendance; the subject matter was obviously of interest to a large and varied audience. Having Porter of Sheffield University as a keynote speaker not only attracted a large audience of experts to hear his paper, but his comments throughout the symposium catalyzed exciting discussions. Without question these two symposia were as outstanding as any ever sponsored by Section C.

M. ORCHIN, *Chairman*
S. L. MEISEL, *Secretary*

American Association of Clinical Chemists (C1)

The program of the American Association of Clinical Chemists included 21 papers and was considered one of the most extensive meetings ever held with the AAAS. While all papers were of high quality, some of particular significance were: "Electrophoretic aids in identification of proteins" by Lena A. Lewis, "Paternity exclusion by paper electrophoresis" by John W. King *et al.*, and "Chemical tests for the evaluation of the effects of drugs on cancer" by Henry C. Damm. The attendance at all sessions was gratifying to the planners and participants of the meeting.

WILLARD R. FAULKNER,
Program Chairman

Geology and Geography (E)

The Section E program at Cleveland consisted of five half-day sessions of papers.

A two-session symposium on polar geology, arranged by Arthur Mirsky and Richard Goldthwait, (Ohio State University Institute of Polar Studies) included participants from at least six different research centers. Subjects ranged from limnology to glaciology to palynology. No doubt remained in the mind of the audience about the extraordinary progress which is being made in determining some of the basic earth science facts of both the north and south polar areas.

A symposium entitled "The St. Lawrence Seaway in relation to the Great Lakes," organized by Albert G. Ballert (Great Lakes Commission), was of particular value to geographers with a special interest in this field. Specialists were able to compare and exchange views with regard to research techniques and possible areas of misunderstanding in the utilizing of agency data.

Guy-Harold Smith (Ohio State University; retiring vice president of Section E) had the honor of hearing four of his former students read papers on an interesting variety of subjects. Each paper had been carefully prepared and was effectively presented. As a conclusion to this session, Smith read his retiring vice-presidential address, "Morphometry of the terrain—advances and challenges."

The session of contributed papers in geology which opened the Section E program on 26 December suffered as a result of the varied nature of the topics on which the authors lectured.

At the meeting of the Section E committee on 28 December there was considerable discussion regarding contributed papers and general disagreement among the members on how to handle this matter. Some committeemen spoke favorably with regard to abandoning the policy of accepting any paper submitted; other committeemen thought the secretary should continue to accept papers. It was decided to make another try for a satisfactory program of contributed papers for Montreal, December 1964. Papers must be submitted to the secretary of the section not later than 1 September. They must be accompanied by a 250-word abstract (Consult the Geological Society of America for advice regarding preparation of abstracts) and submitted in triplicate, double-spaced. The secretary would particularly like to hear from research program directors and others who might like to organize a symposium of six to ten papers centering around one general topic. The section particularly seeks papers which will attract the attention of scientists in the Montreal region.

Finally, the Section cosponsored a session of invited papers, arranged by the National Speleological Society, which dealt with the geology of the Mammoth Cave Region. Attention of the geography group was also directed to the two sessions of excellent papers arranged by the AAAS Committee on Deserts and Arid Zones.

RICHARD H. MAHARD, *Secretary*

Association of American Geographers (East Lakes Division) (E1)

A session of invited papers honoring Guy-Harold Smith included four papers by former students of Smith. Each represented some facet of Smith's broad interests within the field of geography. Arthur H. Robinson (University of Wisconsin) described the solution and the empirical procedures employed to design an uninterrupted map projection of the entire earth with (i) parallel parallels, (ii) a uniform scale along each parallel, and (iii) the best possible appearance of the more important sections of the major land masses. David W. Lantis (Chico State College) proposed a modification of climatic classification that still recognizes latitude (insolation) as the basic determinant of climate and suggested four primary symbols to identify major zones: T (tropical), ST (subtropical), ML (middle latitude), and P (polar); each type would be further subdivided on the basis of other controls. Val E. Eichenlaub (Western Michigan University) used synoptic climatology to correlate the distribution of snowfall over the lower peninsula of Michigan with the prevailing atmospheric situations of the region. The dynamic effect of the lakes as sources of heat in the winter season and the resulting increase in snowfall along with the formation of "snow belts" on the lee shores of the lakes were clearly demonstrated.

ALDEN CUTSHALL, *Program Chairman*

National Speleological Society (E4)

The National Speleological Society cosponsored two special sessions, both held 27 December. G. W. Moore (U.S. Geological Survey) arranged a series of invited papers on the geology of the Mammoth Cave region of Kentucky; this program was cosponsored by the Geological Society of America and the section on Geology and Geography (E). A review of the stratigraphy, structure, and physiography of the central Kentucky karst was presented by R. A. Watson (Michigan), W. B. White (Pennsylvania State), and E. R. Pohl and R. W. Brucker (Cave Research Foundation). In other papers, White discussed deposition and origin of sulfate minerals, abundant in caves of the area; and (with G. H. Deike, Pennsylvania State) the paleohydrology of Mammoth Cave and the Flint Ridge Cave system. Data on hydrochemistry and sedimentation in the underground rivers of Mammoth Cave were presented by C. R. Collier, R. A. Krieger, and G. W. Whetstone (U.S. Geological Survey). Moore and B. G. Nicholas (LaSalle College) reported on an observed seasonal fluctuation in the geothermal gradient in Cathedral Cave, a small cave in Mammoth Cave National Park.

T. C. Barr (Kentucky) arranged a series of invited papers on cave ecology; this program was cosponsored by the Ecological Society of America (FG5). The fact that five of the nine papers dealt directly with the Mammoth Cave system reflected increased interest in the biospeleology of this region. Barr reviewed the composition and evolution of the Mammoth Cave fauna, and O. Park and D. Reichle (Northwestern) stressed the special significance of the cave cricket, *Hadenoecus subterraneus*, in the food web of the terrestrial cave community. Limnology of Mammoth and other caves was discussed in papers by R. A. Kuehne (Kentucky), T. L. Poulson (Yale), and P. M. Smith (Cave Research Foundation). T. C. Jegla (Minnesota) reported seasonal peaks in molting and reproductive periods in an Indiana population of troglobitic crayfishes. Patterns of geographic distribution of troglobitic invertebrates in the Appalachian valley of Virginia and West Virginia were reviewed by J. R. Holsinger (Kentucky). Bat hibernation and the fall swarming of bats in the Mammoth Cave region were topics of papers by J. S. Hall (Albright College) and W. H. Davis (Kentucky), respectively. The discovery that algae are widespread and abundant in the aphotic zone of caves and some of the results of recent investigations of cave algae were reported by G. Claus (New York University Medical Center).

A semiannual meeting of the Board of Directors of the National Speleological Society was held 28 December.

T. C. BARR, *Executive Vice President*

Zoological Sciences (F)

Sectional activities included participation by 10 affiliated societies spearheaded by the American Society of Zoologists and the Ecological Society of America. The areas of behavior, comparative physiology, and animal and plant ecology were particularly well covered in both symposia and sessions with contributed papers. Fewer, but nonetheless significant, papers were concerned with developmental biology, vertebrate morphology, cytology and genetics, comparative endocrinology, and photoperiodicity.

Two programs, representing different approaches to the dissemination of scientific knowledge at the AAAS meeting, may be singled out for special comment—the refresher course in behavior genetics and the interdisciplinary symposium on developmental aspects of immunity. In the former one-day symposium, arranged by Ernst Caspari, many aspects of the zoological sciences were discussed and many new data were contributed by nine experts in the field, after which the audience joined in an open discussion. These papers (to be published in the *American Zoologist*) pointed up the use of genetics as a tool in the understanding of behavior and the importance of behavioral patterns in interpreting evolutionary development and speciation.

The one-session symposium on the developmental aspects of immunity brought together four points of view and four lines of investigation bearing on the dynamic aspects of immune responses which are characteristic of the discipline in its own right. Under the presiding officership of James Ebert, the sequential, thymus-related, evolutionary, and neonatal features of primary and secondary immune responses in vertebrates were discussed by Jonathan Uhr, Jacques Miller, Robert Good, and Arthur Silverstein, respectively. Many new experimental facts, developmental relationships, and interdisciplinary interpretations were revealed.

Social functions included society and sectional luncheons, the Zoologists' Dinner, and the Biologists' Smoker held at the Cleveland Natural Science Museum. Arthur D. Hasler (Wisconsin) was elected chairman of Section F for 1964; John A. Moore (Columbia) was elected committeeman-at-large (1964-1967).

DAVID W. BISHOP, *Secretary*

131st AAAS Meeting

The 131st annual meeting of the AAAS will take place in Montreal, Canada, 26–30 December 1964. Details on the program and information about the city will appear in *Science* throughout the year.

American Society of Zoologists (F1)

Vertebrate Morphology, Session I. Malcolm T. Jollie indicated that the "pits" observed by others in the cranial bones of caecilians may represent a complex sensory system similar, at least in function and innervation, to the lateral line system of acquatic amphibians.

Kinesis in all tetrapods may be traced back to the crossopterygian condition, according to Walter J. Bock. The presence of a kinetic hinge—which is usually crushed and obscured in fossils—is accompanied by a basitemporal articulation which provides a necessary second point of articulation. The basitemporal hinge is usually well preserved in fossils and its presence means that a kinetic hinge must have existed in the same specimen.

The paper by Elazar Kochva supports the view that the proteroglyph and solenoglyph snakes arose separately from the proterodont and opisthodont colubrid-type snakes. The new evidence provided for this theory is based on studies of the venom glands and their innervation. Evidence suggests that the venom glands and compressor muscles in these two general groups of snakes are not homologous.

The report by Warren F. Walker, Jr., on the forces developed at the feet of turtles in walking provides additional evidence on the general subject of vertebrate locomotion. Such data will no doubt provide the basis from which will arise new ideas on functional morphology and vertebrate evolution, particularly regarding the shape and volume of the animal and the distance between the animal body and the substrate.

The details of the sebaceous gland complex in the gerbil (*Meriones*) by Douglas B. Webster is of interest because it provides another character which should be investigated to determine its importance in studies of rodent phylogeny.

RICHARD J. BALDAUF, *Presiding Officer*

Vertebrate Morphology, Session II. The split-brain preparation was used by Theodore J. Voneida (Western Reserve University) in investigating the neural pathways of conditioned reflexes. Although the visual stimulus can be restricted to one half the brain by section prior to training, the sensorimotor cortex of the other half is still involved in the response. It was suggested that the efferent pathway for the front paw response (on the same side as the visual stimulus) decussates above the caudal boundary of the pons and forms synaptic contact subcortically with the visual center.

Paul T. Medici described a number of experiments involving the control of blood cell number. Polycythemia could be achieved by injection of homologous red blood cells into the peritoneal cavity of the rat. Such cells were absorbed by way of the lymphatics. This artificial increase in the number of erythrocytes depresses the cell production of the bone marrow. Such inactive marrow can then be used to test erythropoietic substances; stimulation is more evident under these conditions. Splenectomy appeared to affect absorption of blood cells and does not aid in achieving polycythemia.

The "existence energy" of birds was discussed by S. Charles Kendeigh. He has produced some interesting figures relating size and energy requirements.

The morphology of the chondrocranial roof of modern anurans was described as of three types, and variations of these, by Richard J. Baldauf. There appears to be a distinct correlation between these types and the evolution of this group.

James M. Moulton described the development of the air bladder connections with the middle ear in the Menhaden. The values of this complex interrelationship were suggested in terms of hearing and depth perception.

The final session, presented by Bobb Schaefer, was devoted to the question of radiation of the Osteichthyes. The discussion involved questions and suggestions from many in the audience, including A. S. Romer, Stewart Landry, Richard Baldauf, Walter Boch, Milton Hildebrandt, and Roland Walker. There appeared to be much interest in this discussion with an expressed desire to know more about source materials and the problems of their interpretation.

MALCOLM T. JOLLIE, *Presiding Officer*

Zoological and Botanical Sciences (FG)

Ecological Society of America (FG5)

Sessions were held for plant ecology, invertebrate ecology, marine ecology, and vertebrate ecology. Janice Beatley showed that much of the damage to vegetation at the Nevada Test Site, which has been attributed to ionizing radiation, is actually caused by other factors. Also, winter annuals of the desert which have been referred to as ephemerals should not be so called; only summer annuals should have that designation. Frank W. Woods and Walter A. Hough explained radiotracer techniques for determining natural distribution of plant roots. Richard T. Hartman and Doris L. Brown reported on the analysis of the internal gases of submerged vascular hydrophytes appearing in both natural and simulated environments. By the use of radioisotope techniques it has been shown that *Lumbricus terrestris* distributes the materials vertically in the soil while *Allolobophora sp.* redistributes the materials horizontally (A. E. Augustson, R. E. Puetz, and Grant Cottam). Allolobophora is a secondary consumer of particles left by Lumbricus. Ian E. Efford described aggregations of the sand crab, *Emerita analoga*, apparently arising from biological factors rather than environmental factors. D. H. Brant and J. L. Kavanau, by recording nocturnal movements of deer mice, *Peromyscus maniculatus*, with infrared television, showed that they may move as much as 3 miles in one night.

RALPH W. DEXTER, *Program Chairman*

Recent Trends in Ecological Research in the Great Lakes. This symposium was cosponsored by the Ecological Society of America and the American Society of Limnology and Oceanography.

Eight speakers reviewed and elaborated on the physical, chemical, and biotic environmental factors in the Great Lakes. Discussions included a history of ecological research (T. H. Langlois) and the importance to the ecologist of Pleistocene geology, paleoclimatology, recent bottom deposits, and so forth (Howard J. Pincus). D. V. Anderson pointed out that few physicists and chemists have been concerned with environmental studies: much of the chemical and physical research has been by biologists and fisheries workers. The necessity was stressed for repeated seasonal studies of whole lakes.

E. B. Henson noted that the main stimulation to work on the bottom fauna has been through consideration of fisheries problems. There is need for a fundamental species inventory for the Great Lakes. In discussing plankton

studies in the Great Lakes, C. C. Davis said that, except to some degree in Lakes Erie and Michigan, there is a decided lack of year-round, detailed quantitative plankton studies. H. A. Regier pointed out that there have been no adequate studies of fish dynamics in the Great Lakes and investigations have largely been based upon crises in the fisheries. Hence there remains controversy on all basic points.

G. S. Hunt described a number of the direct effects of pollution in the Great Lakes on the life of birds, fishes, and so forth. A. M. Beeton stated that only Lake Erie is eutrophic. The influence of man, evident in the eutrophication of Lake Erie, is probable in all the lakes.

The symposium closed with a presentation of future research needs and plans.

CHARLES C. DAVIS, *Arranger*

Use of Morphological and Autecological Characteristics of Plants in Community Gradient Analysis. The fundamental advantages of using coordinates in multiple dimensions to study variation in plant communities was demonstrated in this symposium. Examples from both the east and west coasts in North America and from the central deciduous forests were cited. E. V. Bakuzis outlined the developing potential of synecological coordinates in Minnesota forests, with emphasis on techniques for graphic representation of four or more dimensions. The coordinate axes are based on the average moisture, nutrient, or heat requirement index for the tree, shrub, and herb species present in the sample. O. L. Loucks (University of Wisconsin) compared the use of synecological coordinates with scalar coordinates obtained by synthesis of diverse environmental data from the coniferous and deciduous forests of New Brunswick, Canada. Although the synecological technique is based only on a listing of the species present in the sample areas, the resulting coordinate positions for moisture, nutrients, and heat at each sample correlate remarkably with the corresponding synthetic scalars. An alternating approach, applied in the coastal redwood forests of California, was provided by R. H. Waring (Oregon State University). Gradients similar to those in controlled-environment research are used to obtain ecological groups and a calculated moisture axis. Plant structure, spatial arrangement and size of plant parts (leaves, twigs, bark, and so forth), plant function, and apparent adjustments to environmental extremes were the bases for the coordinate approach used by D. H. Knight (University of Wisconsin). This method does not require identification of unfamiliar vegetation, yet results in coordinate representation of the ecological factors. Pierre Dansereau was ill and unable to present his paper personally. A summary was distributed and an abstract has been published.

O. L. LOUCKS, *Program Arranger*

Botanical Sciences (G)

Section G concentrated its program into 1 day (30 Dec.). For the third year, a symposium entitled "Plant biology today: advances and challenges" was presented. The two morning papers concerned symbiosis, the first by Vernon Ahmadjian on cultural and physiological studies of the lichen symbiosis and the second by John J. A. McLaughlin on algal symbionts in marine animals. In the afternoon the first paper by Henry N. Andrews reviewed significant advances in our knowledge of higher pteridophytes and the origin of seed plants. This was followed by a report on recent research on electron transport carriers in respiration and photosynthesis by Walter Bonner. The afternoon was completed with a paper by Charles E. Hess on naturally occurring plant growth regulators.

The luncheon for botanists included an address by the retiring chairman of the section, Aaron J. Sharp. It was entitled "The compleat botanist," and was a thoughtful and forceful plea for botanists and biologists to maintain and develop a broad view of their subject and its importance to an understanding and intelligent management of our world.

HARRIET B. CREIGHTON, *Secretary*

Psychology (I)

In the symposium, "Learning research pertinent to educational improvement," reports were given of experimental evaluation of new methods of instruction relevant to reading, mathematics, and problem-solving behavior. A common problem investigated in each of these areas concerned the question of the degree to which choices in the direction and approach to learning can be determined by the learner himself and still result in an effective outcome. The evidence showed that discovery and self-direction yield superior learning under some conditions.

In the vice-presidential address, L. G. Humphreys emphasized how the intra-individual variability in many kinds of performance usually increases with lengthening of the interval between tests.

The papers in a symposium cosponsored by Section U provided a number of illustrations of the use of multivariate statistical techniques to yield relevant analyses of data from experimental psychology. R. Darrell Bock outlined the extension of analysis of variance from the traditional univariate case to the multivariate case, with examples drawn from educational psychology. Keith Smith reported on studies of speech and speaker recognition by electronic and computer methods. Warren Torgerson discussed problems in multidimensional psychological scaling as dependent upon a problem of the appropriateness of equating similarity in perception to distances in the model.

In the symposium on "The development of perception during the first six months of life," Robert Fantz described experimental data indicating that human infants, from birth, can see and discriminate patterns as the basis for form perception. He pointed out that during the third month of life unlearned visual selectivity begins to be modified by past visual experiences. Evidence was presented to support the view that visual perception precedes action in development, rather than the reverse as is often assumed. Burton White reported that environmental enrichment and additional handling significantly increase the attention of institutional children to external objects.

The symposium on engineering psychology dealt with new work in the areas of photo reconnaissance, real-time simulation in air-intercept problems, and complex human performance under high gravity conditions. The research described by R. Chambers, most of which was carried out on the Johnsville, Pa. AMAL centrifuge, was exceptionally complete and authoritative. Some of this work was based on recent findings in the Mercury astronaut training program.

The vice president for Section I in

1964 will be Lorrin Riggs (Brown University) and Carl Duncan (Northwestern University) joins the Section Committee as member-at-large.

FRANK W. FINGER, *Secretary*

Social and Economic Sciences (K)

National Institute of Social and Behavioral Science (K6)

The program of the National Institute of Social and Behavioral Science constituted a session for contributed papers. Joseph J. Lee (Michigan State University) developed material on the Latin American policy of Communist China and stated that it was the objective of such policy of the Peking regime to establish ideological leadership in revolutionary movements by identifying them with the Chinese revolutionary tradition and convincing Latin Americans of the strategy and applicability of the relationship. The Chinese ideological penetration is based upon cultural contact and exchange, largely through the device of visiting delegations to the China mainland. (In 1959–60, 220 delegations from 21 Latin American countries visited Communist China.) A leading observer and host is Kuo Mo-jo, vice premier and president of the Chinese Academy of Science. The recent Cuban experience has followed precisely the Chinese model of revolution and extends itself throughout virtually all Latin America today.

An assessment of the current industrial technology of Communist China was offered by Sidney Klein (Rutgers University). His analysis indicated the deteriorating Sino-Soviet relationship has sharply restricted Chinese economic development and has caused in large part industrial and technological difficulties. Currently, food production and light industry are merely stable, while heavier industry is at a low level of output. Foreign trade has shifted noticeably outside the Soviet bloc countries (presumably an important sustaining factor for the Peking government). Klein forecast a continuing low capacity for investment in capital goods and a plateau in general economic activity in the immediate future.

Wladimir Naleszkiewicz (Marquette University) presented an econometric analysis which derived import demand functions of the European Economic Community for American agricultural exports and projected them as a basis for trade policy decisions. In his study a stepwise multivariate correlation and regression analysis was performed on available data using a number of independent variables in various combinations. Accounting for conditioning factors of income and price elasticity, foreign exchange and the real capacity to import, substitute commodities, multilateral trading, and ocean freight, the projections to 1966 indicated a significant decline in exports of wheat, cotton, and feed grains and an increase in such items as animal feed, hides and skins, rice, and meat. The projections are relevant for international price adjustments and for tariff and commercial treaty policy.

The accuracy of international balances of payments was treated by Max J. Wasserman (University of Kentucky). The usefulness of these statistical compilations by over 80 nations was recognized, but the assumption of their complete and authoritative nature was held not necessarily warranted. Exchange control records, for example, may not provide technicians concerned with balance of payments with the required information for a number of reasons. Problems arise in both the linked and non-linked debit and credit systems of source data. Concepts of surpluses and deficits vary, but the principal items used in measuring basic and over-all balances are gold, foreign exchange assets and liabilities, and other short-term capital. Because of different definitions of surplus and deficit, total surpluses of nations do not equal their total deficits and are not always internationally comparable. Likewise, the definition factor can overstate a deficit or understate a surplus. And by implication, the size of the deficits in the United States balance of payments in part may have induced an excessive outward flow of gold.

Amitai Etzioni (Institute of War and Peace Studies, Columbia University) set forth the various approaches sociologists may offer to studies in disarmament and arms control and to international behavior by means of macroscopic analyses. Such studies may be facilitated by a trend toward gradual development of a world community, with a single set of institutions. The recognition of sociological facts provides one contribution of sociology in this area; for example, the discovery of the tendency of most Americans to wait for guidance from the President for interpretations of new events. Another contribution is that of the sociological theorem, as that which states that peoples whose sociological characteristics are similar are most likely to become friends. A third contribution is that of sociological method or research technique, such as the use of the survey to reveal what others think, feel, and believe. Finally, the contribution of sociological perspectives is offered in which the sociologist participates in the decision-making process in international relations, together with other social scientists. This function of perspective is gradually increasing.

The final paper of the session was presented by Lawrence La Fave (Detroit Institute of Technology) on the subject of social change without nonconformity. This study offered a connecting link between the functional and historical approaches to sociological theory. It was held that conformity is more usefully considered to a range, rather than to a point (the latter as by Stouffer and Sherif), and that constant rather than random social slippage is important. Conformity to the range may be skewed so that measures of tendency hover to one side midpoint of the range. Continued over time, a constant social slippage results. When social slippage along a dimension continues in the same direction and the final range contains no points coinciding with original points, then the social norm has changed completely. Thus, there is social change without nonconformity and a connecting link between the two major theoretical approaches to sociology is obtained.

Selected papers from this session and possibly from other sessions in the K series will be published by the NISBS in its *Symposia Studies Series.*

DONALD P. RAY, *Program Arranger*

Population Association of America (K7)

The invited papers on population studies (27 Dec.) dealt with the slow growth and actual depopulation which is occurring over a large area of the United States, the migration of Negroes from the South, and the ecology of the Negro population in the city.

No fewer than 3 million Negroes have left the South since 1940, and by 1980 over half the nation's Negroes will probably live in northern and western metropolitan centers. By the year 2000, little more than a quarter will remain in the South and there will

be almost as many Negroes in each of the other regions. Negro migration from the South has been selective for the better educated. However, the educational level of Negroes outside the South is lowered by migration because the migrants are not as well educated as nonsouthern Negroes.

Actual depopulation is occurring over large areas in the United States. In approximately 100 counties there are more deaths than births, and there are counties in which depopulation has so reduced the taxes available that mandated obligations cannot be met. The great agricultural and mining interior of the country will continue to lose population to the metropolitan centers of the Atlantic, Pacific, and Gulf coasts, and the Great Lakes region.

The concentration of Negro population in small areas near the heart of our largest cities is extraordinary. Nevertheless, there is a clear pattern of increasing social status as distance from the center of the city increases, an ecological pattern similar to the traditional one of whites. The concentration of Negroes and other poorly educated peoples in the city presents a unique opportunity for the efficient development of human resources. Whereas the Negro has demonstrated his ability to swing metropolitan, and perhaps national, elections, there is in the long run a limitation to Negro political power implicit in the high urban concentration. Under a federal system, Negro voters can influence relatively few elections to state legislatures or to the United States House of Representatives. The burden of developing human resources is increasingly placed upon the cities without compensating aid from state or national governments.

This session was sponsored by the Population Association of America and the American Sociological Association.

EVERETT S. LEE, *Program Officer*

History and Philosophy of Science (L)

The economics symposium (26 Dec.) was useful and moderately attended. The symposia on 27 December were both excellent, highly stimulating, and well attended by both philosophers and scientists. The quality of the major papers at the cosmology and cosmogony symposium was truly first-rate, but the attendance was disappointingly low, considering that it was an all-AAAS symposium and that a sizeable ballroom had been reserved for this session. The Sunday afternoon (29 Dec.) vice-presidential address was very well attended, and judging by the numerous comments and requests for copies of it, was very well received. The Sunday evening session was attended adequately and stimulated a great deal of discussion from the floor. President T. Keith Glennan's reception and cocktail party for Section L at his home was sponsored by the department of humanities and social sciences at Case Institute of Technology and proved to be a well-attended social event. It was a catalyst of much follow-up discussion of the earlier sessions. While the Monday session (30 Dec.) was of high quality, attendance was only moderate. However, the evening session, also of high quality, was well attended. I have the overall, definite impression that, although attendance was decimated by conflicts with meetings being held by other professional societies simultaneously in other cities, the sessions served a very useful purpose and that valuable publications will result from them.

ADOLF GRÜNBAUM, *Vice President*

Engineering (M)

The interface between science and engineering is a very hazy boundary line, according to the three participants in the panel discussion jointly sponsored by the AAAS and the American Society for Metals (27 Dec.). Today, the two disciplines are moving closer and closer together, and many engineers now strive to attain research-oriented doctor's degrees. Resulting conflicts of authority can only be resolved by assigning definite responsibilities to workers in the appropriate area (H. K. Work). However, strong bands of interdependence will always remain, and will result in crossover between the two fields.

This crossover of knowledge is needed, according to E. A. Trabant. In the past, it resulted in major advances. Practical power generators developed from electrical theory, while thermodynamics theory arose from the pioneer work of engineers. And today, solid state physicists, electronic engineers, and metallurgists work together to devise better, more versatile transistors.

Bringing the discussion to a close, R. J. Raudebaugh noted that such cooperation was implicit in the educational background of scientists and engineers—student engineers study scientific principles broadly and deeply, learning to apply them in a practical manner, while future scientists work with engineering equipment in their research. Engineering and science, according to Raudebaugh, should be closely related, working hand in hand to help society grow.

CARL R. WEYMUELLER, *Associate Editor*, Metal Progress

Pharmaceutical Sciences (Np)

Section Np held eight sessions which included 23 contributed papers and two symposia. Nine of the contributed papers were in the area of hospital pharmacy. Herbert L. Flack and Charles M. King discussed the need for a formal course in administrative principles for the hospital pharmacist and went into detailed description of course content. Louis P. Jeffrey emphasized that hospital pharmacists should be actively engaged in research and development and that over a period of approximately 10 years there has been little increase in the amount of research being conducted by hospital pharmacists. Discussants of this paper appear to agree wholeheartedly with Jeffrey and many felt that it was essential that the hospital pharmacists make their contributions to pharmaceutical research.

Don E. Francke presented the vice-presidential address entitled "International pharmaceutical abstracts—origins and objectives." Beginning in January 1964, the American Society of Hospital Pharmacists will publish *International Pharmaceutical Abstracts.* The abstract journal will be published in English, 24 times a year, and indexed cumulatively twice annually. Initial plans call for at least 6000 abstracts annually and the index will strive to bring out the pharmaceutical implications of the articles abstracted.

The first symposium entitled "Teaching responsibility of the hospital pharmacist" was held on 27 December. Clifton J. Latiolais (Ohio State University) served as presiding officer and papers were presented by Sister M. Gonzales (Mercy Hospital, Pittsburgh), Paul J. Pierpaoli and Milton W. Skolaut (National Institutes of Health), John A. Autian (University of Texas), and Henry J. Derewicz and Daniel H. Yeoman (Touro Infirmary,

New Orleans). The main emphasis of the symposium was the role of the hospital pharmacist in various teaching programs within the hospital institution, particularly in nursing education.

Fourteen original papers in the areas of pharmacognosy, pharmacology, pharmacy, physical pharmacy, pharmaceutical chemistry, and radiochemistry were presented at the 7th session. Sandford L. Skinner, James W. McCubbin, and Irvine H. Page (Cleveland Clinic Foundation) discussed the control of renin release by the kidney and suggested that renal baroreceptors, sensitive to change in mean renal perfusion pressure, appear to control secretion of renin by the kidney. John A. Autian, Sidney A. Rosenbluth, and Joseph L. Mitchell (University of Texas) discussed the tissue reactions to polyvinyl chloride plastic material which is the component of urinary bags produced by two different manufacturers. Ralph Grunewald, Paul L. Ziemer, and John E. Christian (Purdue University) described a quantitative technique for the determination of organically bound iodine by neutron activation analyses which shows potential as a control procedure for a variety of industrial preparations. Wayne V. Kessler, John M. Watts, and John E. Christian (Purdue University) discussed two methods of synthesis of pyrrolidine-2-C^{14}. Robert K. Chalmers and Carlton K. Erickson (Purdue University) noted the effects of tremorine, arecoline, and chlorpromazine on shuttlebox avoidance and visual discrimination approach responses in albino rats. Six papers were presented by investigators from the University of Pittsburgh in the areas of pharmacognosy, pharmacy, and pharmacology.

The final session was a symposium on the phenomena of drug abuse and drug dependence. Lee H. MacDonald (Upjohn Company, Kalamazoo, Michigan) presided and papers were presented by William R. Martin (director, Addiction Research Center, U.S. Public Health Service Hospital, Lexington, Kentucky), Carl F. Essig (Addiction Research Center, U.S. Public Health Service Hospital, Lexington, Kentucky), Robert E. Edwards (Psychopharmacology Service Center, National Institute of Mental Health, Bethesda, Maryland), and John D. Armstrong (Alcoholism and Drug Addiction Research Foundation of the Province of Ontario, Toronto, Canada). The speakers discussed the addictive properties and the abusive use of narcotic analgesics, barbiturate and sedative drugs, central nervous system stimulants, and alcohol. Emphasis was placed on the addictive and toxic properties of barbiturates and other sedative-type compounds. This symposium was cosponsored by Section N (Medical Sciences). Our section in turn cosponsored the four symposia that were presented by Section N.

Luncheon, refreshments, and dinner were sponsored by E. R. Squibb and Sons, Wyeth Laboratories, and McKesson and Robbins, Inc., respectively.

The officers and representatives from the sponsoring societies met and formulated the program for next year's meeting in Montreal. Lee H. MacDonald is the new vice president and chairman of Section Np for 1964, and John A. Autian was elected a committeeman-at-large to succeed Don E. Francke.

JOSEPH P. BUCKLEY, *Secretary*

Agriculture (O)

The newly developing countries are presently undergoing a fundamental shift in goals—accepting progress for the first time as the basic target of their national aspiration. Successful pursuit of progress as the foremost ideal will require deep-going transformations of inherited institutions which have been developed for other purposes, into a new set which will serve as effective vehicles of change and development. Institutions of agricultural research, education, and extension will require substantial overhauling to orient them toward service to farmers. Countries wishing to jump into the stream of economic progress must be willing to alter their institutional structures.

In some of the developing tropical countries the presence of high mountains and fertile valleys provides an almost unbelievable variety of climatic conditions. Plant and animal scientists in all disciplines have an unusual opportunity to explore an infinite number of relationships in plant and animal nutrition, physiology and genetics, and in plant and animal pathology. Most of the milk cattle in favorable climatic areas of the developing nations would show dramatic increases in production if fed and cared for according to U.S. standards. Some of the most significant researches are those carried out jointly by agronomists and animal nutritionists. The study of native feedstuffs, improvement of their utilization through better grazing systems, improved processing and storage during unfavorable grazing seasons, and increased yields through use of fertilizer, irrigation and other cultural practices, together with the study of new crop introductions, offer excellent opportunities for increase of livestock production in many areas.

Partly because of the low social status of cultivators in many newly developing countries, some people assume that agriculture is simple. Many local technicians and outstanding technical advisors tend to think in terms of single, slogan-like programs for emphasizing one or two practices such as improved seeds, green manures, irrigation, runoff control, pesticides, and fertilizers. Yet any one of these by itself is likely to give only low returns whereas the right combination of practices for the right kind of soil might give increases of 100 to 600 percent.

Most underdeveloped countries have a surplus of people on farms trying to make a living and they should encourage a migration of youth to urban centers. They should not, however, broaden the gap between urban and rural people by exporting the educated and keeping the uneducated on the farm, if they wish to improve their agriculture. Modern scientific agriculture does not thrive in the hands of illiterates or laggards. In developing countries primary education has long-term payoff implications. Secondary education, with a bias for college preparation, along with practical vocational skills and job training is fundamental. Much of the higher education at the college level needs to be critically reviewed from the standpoint of practical utility, job opportunity, and contribution to basic needs of a developing economy. In many newly emerging nations higher education tends to be characterized as classical education for sons and daughters of the class society. Greater opportunity and emphasis are needed for technical and economic functional education for the masses to mobilize and husband the human resources for maximum development.

Failure to develop an effective system for producing and distributing improved seeds, fertilizer, pesticides, and other production supplies is a major factor limiting production in many developing countries. Lack of suitable credit facilities for agriculture is another limiting factor of major importance. Foreign assistance agencies have

not devoted enough attention to these fields nor to transportation, storage, and marketing. A developing country that wishes to substantially increase production by shifting from a traditional agriculture to an agriculture based on modern science and technology must be prepared to make large investments in education, research, extension, transportation, storage, processing plants, and marketing and credit facilities. Heavy investments may also be necessary as part of a program of land reform. This is not always fully understood by the leadership of developing countries.

Programs designed solely to enable farmers in traditional agriculture to increase their investment in precisely the same type of agricultural factors that have been used for generations fail for lack of acceptance because the payoff is too low. Improving the quality of agricultural inputs and supplying them at a price that will make it worthwhile for farmers to acquire them and to learn how to use them efficiently hold the key to economic growth from farming. The agricultural inputs that hold real promise must come predominantly from outside of agriculture. This is obvious in the case of such material inputs as the production of commercial fertilizer, machinery, tractors, and insecticides, and in the development of genetically superior plant varieties and animals. It is less obvious, yet true, in the case of improvements of the level of skills of farm people. The fruit from the advance in knowledge that is useful in economic endeavors is to a large extent dependent upon new skills. The skills required for modernizing agriculture pose the issue of investing in farm people. How to do this most effectively is a matter about which we know all too little as yet. Crash programs are warranted under some circumstances. So are demonstrations designed to instruct farmers. There is also a place for some on-the-job training, but investment through schooling is probably the most economical way when one takes a 10- to 20-year view of this process.

This symposium program of Section O was comprised of four half-day sessions, held on 29 and 30 December. The speakers were prominent scientists with wide experience in fostering the development of agriculture in newly developing countries. Total attendance at the four sessions was in excess of 200, and consisted of leaders in agriculture from universities, governmental agencies, and private foundations. The open discussions that followed each half-day of papers added depth and scope to the subjects presented.

This symposium was arranged by A. H. Moseman (Rockefeller Foundation) who served as chairman of Section O for 1963 and has been designated as committeeman-at-large for Section O for a 4-year term beginning in 1964. The 1964 chairman of Section O, with additional position as a vice president of AAAS, is Edward F. Knipling (U.S. Department of Agriculture). Dr. Knipling, a well known researcher in entomology, will arrange the 1964 symposium program on pest control, by chemical and biological means.

A. H. MOSEMAN, *Chairman*

Education (Q)

There was a general impression that the quality of the programs was unusually good. The papers and programs reflected the current interests in education: provisions for the gifted, research models and techniques, manpower needs and career development, the new curriculum projects, and the social impact of new developments in science and technology.

Attendance was satisfactory at most sessions and spirited discussions frequently occurred. The teaching societies had their usual schedule of excellent sessions which were well attended.

A meeting of the Section Committee was called and one of the main items of business considered was use of funds which have recently become available to the section through action of the Board of the now defunct Council for Research in Education. Ullman and Finger, secretaries for Sections U and I, respectively, attended the meeting on invitation. The discussion was intended to provide guidance for the new secretary of Section Q, Frederic Dutton, and the new vice president and chairman, Herbert Conrad.

A short business meeting was held and the secretary outlined in brief the structural organization of AAAS and the methods which Section Q has adopted for the selection of its officers. The meaning of "Fellow" status and the provisions in the AAAS constitution were briefly considered.

The meeting adjourned with the introduction of and brief comments by the new section officers.

HERBERT A. SMITH, *Retiring Secretary*

AAAS Cooperative Committee on the Teaching of Science and Mathematics (Q1)

In a panel presentation, representatives from commissions on college science outlined the deveolpment, present status, and plans for the immediate future of their respective groups.

The Advisory Council on College Chemistry, formed in recognition of the significant changes in high school chemistry courses, intends to obtain, organize, and disseminate information on improving college chemistry instruction. It hopes to catalyze and seek support for experimental programs. In addition to publication of a newsletter, it is forming study groups on general chemistry, curriculum and advanced courses, teaching aids, teacher development, and courses for non-scientists.

The Commission on College Physics has similar broad objectives and activities. It also assists in organizing conferences for college physics teachers. It is encouraging development of a new full-year introductory physics course for science and engineering students, and of one or more physical science courses for students who have little background in mathematics.

The encouragement of significant curricular experimentation is the primary purpose of the Commission on Undergraduate Education in the Biological Sciences. It will concentrate its efforts on undergraduate curricular organization, introductory college biology, biology teacher education, and summer institutes for college biology teachers.

The Geological Education Orientation Study presently is emphasizing a detailed study of the geological sciences in a broad spectrum of colleges and universities. Through subsequent action panels, it aims to identify significant trends, to provide guidance to institutions, and to assist faculties in meeting changing requirements.

The Commission on Engineering Education seeks through its three major committees to stimulate the development of projects by individuals and groups. Thus, one committee on faculty and institutional development brought about a survey of institutes and seminars for engineering faculties. An extensive case writing project is developing through activity of the committee on design, while the committee on educational resources is active in materials exhibits and film production.

EMERY L. WILL, *Secretary*

Science Teaching Societies (Q9)

"Science and children: partners in discovery" was the main theme of the elementary school science symposium of all science teaching societies.

By the time children enter kindergarten they already have been actively involved in discovery for about 5 years. Young children seek stimulation. As babies in the playpen they are busy investigating their environment, using every means at their command. Then and later, they are not content to wait for the world to come to them. They are attracted by and are curious about everything in sight. Children also seek stability—a feeling of well-being. This they begin to acquire as they make discoveries which help them understand the environment which once represented mass confusion. As these cognitive processes continue, children further refine their discriminatory abilities. If their attempts at learning through experimentation and interaction have been satisfying, children are, when they enter school, excellent subjects for science teaching. Knowledge of children, their needs, their interests, and how they learn is essential to successful science teaching in the elementary school. The successful teacher of elementary science should also keep in mind that:

1) Science teaching, at its best, is highly personal. The kindergarten child is not only interested in what makes lightning, but also in what it will do to *him*. He must work at solving problems that matter to him.

2) Problem-solving experiences must be carefully planned by the teacher. Her role must be that of guiding a child toward discovery, rather than setting up a step-by-step procedure to "prove" some predetermined answer to be correct. Science is a *way* of learning, a process, a method of discovery.

3) Science is also a body of knowledge. Problem-solving is not an end in itself. It contributes to a fund of knowledge which can be used to solve additional, more complex problems. Knowledge of the content of science is essential if the child is to become scientifically literate in today's world.

4) The science curriculum must be planned. The incidental curriculum of yesteryear robs a child of a balanced program in science and often leads to boring repetition as he moves through the grades.

The elementary teacher who would be an adequate science teacher must: (i) be a perpetual student of children —how they learn and grow; (ii) be a perpetual student of science; and (iii) exhibit enthusiasm for both science and children.

Panelists discussed specific ways in which children are led to discovery in science experiences in grades 1, 3, and 5. The fifth grade science TV teacher described how even a telecast lesson can be so carefully planned and presented as an open-ended lesson that it provides opportunity for discovery, rather than becoming an information dispensing operation.

MILDRED BALLOU, *Program Chairman*

National Association of Biology Teachers

The four-session program of the NABT covered subjects ranging from cellular biology to collegiate curricula for biology teachers.

In discussing molecules, membranes, and molds, John W. Greenwalt (Johns Hopkins School of Medicine) noted how electron microscopy and thin sectioning techniques have made possible a more thorough understanding of cell structures and functions. Investigations of the mitochondrial membrane have shown this structure to be important in respiration and energy transformation as well as in the active transport and accumulation of ions. Mitochondria vary in size and shape from one cell type to another. The physical and pathological state of the cell influences the size of the mitochondria.

Research on the differential lytic reactions of some bacterial species has indicated that a need exists for a more simplified method of identifying various members of the genus *Achromobacter*. Thus studies were made of the lytic action of lysozyme in the genus *Achromobacter*. Experiments indicate that the sensitivity of various species of this genus to lysozyme may be used in developing a simplified technique for identifying different members of this genus (Ted E. Surdy, Kansas State Teachers College).

In studies on plant pectins and their function in food texture, it has been shown that the protopectater and water insoluble calcium pectates are responsible for the rigidity of cells and firmness of texture in fruit. The nutrient elements, particularly potassium, will alter the pectin content and therefore, the firmness of the fruit. Doubling the recommended amount of potassium in the soil significantly reduced the amount of calcium in both the leaf and the fruit of plants. This shifted the pectin-protopectin ratio to a more water soluble form, resulting in a poorer texture quality and a significant loss of juice in the fruit (Frank J. McArdle, Pennsylvania State University).

One of the sessions was devoted to innovations in teaching botany and biology at the high school and college levels.

James Wickliff (Iowa State University) told how single concept films are being made for use in college botany classes. The films, illustrating basic plant processes which are difficult or impossible to show through laboratory exercises, are made in such a manner that they may be integrated either into a discussion of life cycles or of the plant processes. Use of the films without sound so the instructor can comment as he sees fit is encouraged.

An effort is also being made to produce such low cost films for use in high school classes. These films are designed so they can be easily integrated into either BSCS or conventional high school biology courses (James Koevenig, University of Colorado).

Another method employed at the high school level to help acquaint biology students with the techniques of research is the system of 6-week laboratory block units. During the 6-week period, the students work exclusively in the laboratory on the investigation of some problem in biology. The units are a combination of open-ended laboratory exercises and exercises which repeat work done in classical experiments (Addison Lee, University of Texas).

The impact of testing of new curricula has been felt in many areas of the educational system. The new laboratory-centered curricula in the high schools has made it necessary to design new tests that are applicable to the new curricula. To date, no text has been designed that is applicable both to the conventional curricula and the new curricula (William Mayer, University of Colorado).

The laboratory-centered courses have also created a need for many facilities not previously found in high school classrooms or laboratories. An adequate number of electrical outlets, a readily accessible supply of water and gas, and large preparation and

storage areas are needed for these courses. Many household appliances—stoves, refrigerators, and pressure cookers—and other ingenious devices are being used to meet the needs of these courses (James Dawson, Macalester Scientific Corp., Cambridge, Massachusetts).

In a session on research activities in high schools, Charles Ostrander (Atwater High School, California) described the development of an electrical device to be used in the classroom which will be useful in daily communication between pupil and teacher; it is known as a multiple integrated response device. Dorothy N. Naiman (Hunter College) discussed a procedure for producing models of various organs. The models, which are cased in rubber, are made of methane and are easily colored or sectioned by the student. G. E. Caraker (Eastridge High School, Rochester, New York) was concerned with the apparent relationship between high school smokers and their academic performance. A study of the academic performance of high school students indicated that smokers did not do as well as nonsmokers.

Collegiate curricula for biology teachers were noted by two educational groups.

1) The Commission on the Undergraduate Education in Biological Sciences has set up a council to study and recommend changes to be made in the curriculum of undergraduate biology majors. Among the areas of action proposed by the council are curriculum revision to include support in physics, chemistry and mathematics, and faculty development through summer institutes for college teachers (Thomas Hall, Washington University).

2) The Commission on the Education of Teachers of Science has found that science courses based on the assumption that all the students in the course will become science teachers best fit the needs of all students. A study of the background of applicants for a Harvard fellowship showed that many top students are not well prepared in their major field and many more of these students have little or no background in any of the related sciences or mathematics (Fletcher Watson, Harvard).

The climax of the convention was the Silver Jubilee Anniversary Banquet honoring the past presidents. Ted F. Andrews, presiding over the program, presented gavel plaques to the 13 past presidents in attendance and to the others in absentia. Special awards were given to Oscar Riddle and C. M. Goethe. Riddle, who was the chairman of the committee that established NABT in 1938, was the special guest of honor. After the presidential address, "Missions, money and men," retiring president, Phillip R. Fordyce, presented the gavel to Ted F. Andrews, president for 1964.

TED F. ANDREWS, *President*

Information and Communication (T)

Noted during a panel discussion on communication of research and development information and the role of the working scientist and engineer was the tremendous growth of successful research and development in recent years—part of the so-called information explosion—and the resultant inevitable problems, strains, possible hostility, and calls for solutions, perhaps even drastic action, in some areas. The comprehensive report, "Science, Government, and Information," issued from the White House by the President's Science Advisory Committee recommends a number of sober solutions. Selected portions of this report were discussed in amplification at another panel meeting (27 Dec.).

A. Weinberg (chairman of the Panel of Science Information) strongly stressed the need for improving the use of language by scientists and technologists—a "project literacy". The unclear way scientists express themselves calls for changes in the style of technical writing—from the present passive, stilted style to one that is active and less formal, and which communicates better. Very preliminary research, in which he participated, indicated improvements could be made. Milton Lee, a member of Weinberg's Panel, facetiously recommended an ego-maximating process—items that reach the readers. He predicted that within 10 years new methods of photo-composition would be available for primary journal publication, whereby an author could set his own copy. Also noted were: (i) the need to eliminate from information transfer systems report matter which is trivia; (ii) greater selectivity and screening; and (iii) more stringent standards for acceptance of research manuscripts (Robert Speers). Charles Stevens amplified the role of the central depository. He indicated that librarians and documentalists basically agreed with the report and hoped its recommendations would succeed, while disagreeing somewhat with specific items. Vernon Root took up the report challenge that scientists and engineers must change some of their basic attitudes. However, even to make scientists and engineers aware that changes are necessary requires a major psychological offensive which can best be carried out through existing professional societies and society journals. After being made aware of the problems in technical communication, the scientist can begin the long, lonely struggle within himself to recognize that he contributes to the problem and must contribute to its solution by altering some of his established attitudes.

Stello Jordan arranged for the panel and presided at the meeting, which was cosponsored by AAAS (Section T) and the Society of Technical Writers and Publishers.

STELLO JORDAN, *Program Chairman*

Control of Metallurgical Information. John A. Fellows (vice president, of the American Society for Metals, and assistant technical director, Research and Development, Mallinckrodt Chemical Works) opened the symposium by reviewing some of the problems with which the researcher must cope.

Cost of providing adequate information resources is a major stumbling block, and the question of whether this cost can be borne by the individual scientist or whether large-scale government support of information resources is required has not yet been resolved. New ways of disseminating individual scientific papers rather than in complete journals, and of providing better abstracts and indexes than are now available, are being explored in the hopes that such combined services can be provided on a subscription basis at reasonable cost.

It has not yet been determined whether information resources can be broken down into sectors, separately administrated yet coordinated, or whether a single omnibus system with all the disadvantages of centralization and goverment administration is the final answer.

Speaking on handling of metallurgical information by government agencies, Donald A. Shinn (Wright-Patterson Air Force Base) pointed out that the federal government has no activity, solely as such, which could be called a "metallurgical information center." It does, however, operate a number of separate information centers in special fields, particularly dealing with materials and their properties. The functions and operations of a number of these were described.

Robert S. Taylor (Lehigh University) dealt with the problem of how the scientific and engineering students are taught to use information, and stressed the importance of learning how to ask questions. The student—who becomes the working scientist—must be cognizant of the various kinds and types of information services in his field so that he can match his needs to the availability of the resources.

Cooperation in metallurgical information handling was discussed by a panel consisting of Frank Speight (American Society for Testing and Materials), G. R. Forrer (Society for Nondestructive Testing), James H. Keeler (American Institute of Mining, Metallurgical and Petroleum Engineers), David Liston (Engineers Joint Council), and Harry B. Goodwin (American Society for Metals). Goodwin, chairman of the session, summarized the discussion by delineating four areas of cooperation:

1) Possibility of revising the whole concept of the way information is handled. This might involve elimination of traditional society "transactions," accompanied by wider distribution of abstracts.

2) Standardization of indexing nomenclature, possibly by thesaurus techniques.

3) Elimination of duplication in abstracting.

4) Combined sales efforts so that information products of various technical and professional societies can become better known to the individual members.

Members of a panel on information retrieval in the world of metals presented a rather full description and exposition of ASM's Information Searching Service, and emphasized its relationships to similar activities in the information processing field. While this pioneering computer-based service is now entering its fourth year of operation, there are many areas of development, refinement, and even drastically new approaches which will be actively explored in the months to come.

The ASM deep-indexed file of some 140,000 documents, is a veritable gold mine for information retrieval research because of the various ways in which the computer indexes can be programmed and manipulated. Some of the future products contemplated by ASM are: (i) statistical examination of terminology used in past searches; (ii) analysis of the indexing terms and codes to eliminate unused or unnecessary terms; (iii) grouping of search files under major subject categories to reduce machine time in searching; (iv) possibility of "inverting" the file to aspect rather than sequential arrangement; and (v) development of new products based on the same indexing techniques now used. For example, the customized central searching service might be supplemented by a broader "interest profile" service or by development of "dual dictionaries" or other products allowing the user to do precise searching at his own desk.

The fast moving field of computer technology will undoubtedly provide both the hardware and software for developing metallurgical information services of greater efficiency, broader usefulness, and less cost to the scientific community.

This symposium was the joint program of the Information and Communications Section and the American Society of Metals, and was cosponsored by the Engineering Section.

MARJORIE R. HYSLOP,
American Society for Metals

Vice-Presidential Address. In his talk on documentation, Foster E. Mohrhardt described it as a newly developed discipline where there is a lack of understanding and agreement concerning the meaning and scope of the term "documentation." There is also lacking a definition of the relationship of documentation to information science, communications, and librarianship.

Beginning with the broad field of communication sciences as the center of this special universe, the relationship of information sciences and librarianship was shown and a differentiation was made between librarianship and documentation. The inclusion of various areas in documentation, such as writing, editing and publishing, not germane to librarianship, coupled with the evaluation in depth by subject specialists indicate the special aspects of documentation. In conclusion, suggestions were made for improvements in documentation and the need for closer relationships between documentalists and specialists in other fields.

PHYLLIS V. PARKINS,
Program Chairman

Luncheon and Business Meeting. Walter Sullivan (science news editor of the New York *Times*), speaker at Section T's annual luncheon 29 December, developed his topic, "A new problem in communication: trying to make contact with intelligent life beyond the solar system," in a logical and convincing manner. He reviewed the scientific background and presented the most recent evidence for the existence of intelligent beings in other worlds, in our own world, and in other galaxies. He explained the kind and pattern of signals that might be expected to transmit messages, and the means developed and developing to monitor and decipher codes. Sullivan noted some evidence for the belief that even now intelligent beings somewhere are trying to establish communications. This was a scholarly and remarkably clear presentation of a highly technical subject, one which Sullivan will develop further in a book to be published soon. Walter Sullivan was this year's winner of the AAAS Westinghouse Award for science writing in the newspaper medium.

Foster Mohrhardt, chairman, presided at a lively business meeting that followed his vice-presidential address. Fourteen of the 19 societies now affiliated with Section T were represented. Ideas voiced, suggestions, and constructive criticisms indicated the great interest and multiplicity of problems surrounding the broad field of science information and communication. Section T programs, it was concluded, should be interdisciplinary in nature to serve most satisfactorily the variety of interests involved in the field.

Pierre Fraley outlined briefly his idea for a program in 1964 to explore the history of the popularization of science, and to explain the steps taken to date to select participants. A number of outstanding individuals in the field have received the idea of the program with enthusiasm and have promised active support and participation.

Newly elected section officers were announced: chairman, Wallace R. Brode; committeeman-at-large, Milton O. Lee.

PHYLLIS V. PARKINS, *Secretary*

Statistics (U)

In his vice-presidential address on statistics teaching in 1974, Harold Hotelling pointed out that standard techniques, when applied without proper checks as to their appropriateness, may lead to erroneous results. The inference for statistical teaching was that either there will be more teaching of statistics based on research yet to be carried out or that much of our present pattern of teaching will include a rich mixture of errors.

At a session for teachers of statistics, Horace W. Norton (University of Illinois) reviewed recent developments in statistics. Most of the discussion at a session on financing graduate studies centered on the difficulties of developing appropriate measures (Thomas J. Mills, National Science Foundation).

"Models in biology," a discussion of models of mortality and aging, illustrated the development through philosophical stages to simple statistical models to the more complex and sophisticated probability models of today (Max A. Woodbury, New York University). The interaction of neurons at a level between physiological study of individual cells and large aggregates and the use of likelihood ratios as a means for discriminating between normal and diseased groups were also among the topics covered.

In a session on organization, search, and retrieval of technical and scientific information Ezra Glaser (U.S. Patent Office) emphasized how the Patent Office is attempting to develop improved techniques of search and retrieval. The technical requirements of such a program were described. A series of models designed to study the consequences of errors were illustrated with actual data. Formal models were also set forth in great generality without restriction on the content or the form of the "file," the type of indexing, or the degree of mechanization.

With illustrations from actual experience, S. S. Wilks (Princeton) reported on the engineering statistical aspects of systems reliability. The implications of a monotone hazard rate on systems reliability were examined and models of complex systems were submitted to a functional analysis.

S. S. Wilks was named vice president of AAAS and chairman of the Section for 1964. Max Woodbury was re-elected for a 4-year term as committee member-at-large.

MORRIS B. ULLMAN, *Secretary*

Science in General

Academy Conference (X1)

The Academy Conference program was initiated on 26 December when 15 papers were presented by Junior Academy representatives; ten academies were represented.

This was the second National Junior Academy of Science meeting and it was the consensus of opinion that another should be held in 1964. A meeting of the directors of Junior Academies of Science was held on 27 December at which a final report in the AAAS-Academy Conference Survey of junior and collegiate academies was made by John D. Hopperton. He noted that there are now 38 junior and six collegiate academies and that a number of senior academies are interested in initiating these activities. (His complete report may be obtained by writing to C. L. Baker, Archivist, Academy Conference, Department of Biology, Southwestern University, Memphis, Tennessee.)

J. Teague Self reported on the National Science Seminars held in conjunction with the 14th N.S.F.-I. He stated that the seminars were very successful and recommended that the Academy Conference request that the AAAS Board of Directors consider supporting similar programs in the future.

A motion was passed and transmitted to the AAAS Board of Directors expressing the interest of the Conference in the seminars and requesting that the Board join with the Conference in taking such steps as may be necessary to sponsor and promote seminars on an annual basis.

A number of speakers emphasized the significance of the contributions of the National Science Foundation to the progress made by state academies and it was the consensus that very few of these programs would have been initiated without the support afforded by the Foundation.

The Academy Conference sponsored the 17th annual Junior Scientists Assembly.

At the annual banquet (27 Dec.) E. Ruffin Jones, past president, presided and President Gerald Acker delivered the principal address. Distinguished service awards were presented by Acker to T. Wayne Taylor and Clint L. Baker.

HARRY J. BENNETT, *Secretary-Treasurer*

American Nature Study Society (X3)

After introductory papers in historic science teaching and early naturalists of the Cleveland region, the theme, "Graphic art, partner of science," was treated in three symposia and supporting sessions. In "Observing nature, basic technique of arts and sciences," eight panelists discussed components of the human environment, atmosphere, rocks, landforms, soil, water, vegetation, wildlife, and man, and noted techniques useful in their study. Two ideas stressed were the cosmopolitan importance of water and the domineering tendencies of man.

A symposium on recording nature showed how graphic arts help train observation and set down information useful for scientific records and for stimulating people to be more aware of their natural environment. (Philadelphia meetings in 1962 dealt with how natural environments stimulate young scientists.) William Scheele (Cleveland Natural Science Museum) demonstrated various graphic media, exemplifying a person who is both artist and scientist. An evening meeting on lenses on nature, at the Science Museum, showed a variety of photographic subjects and techniques.

A successful innovation was "The naturalists at home," showing of slides by members reporting their recent nature study activities; they ranged from Roman Vishniac's molecular photography to E. L. Palmer's report on the Kenya meeting of the International Union for The Conservation of Nature. Howard Weaver reviewed interpretive methods at parks and nature centers and K. Grace Brown illustrated horticultural techniques stimulating city children in the natural sciences. Other members reported nature study in Switzerland, Africa, and New Zealand.

After a day's indoor orientation by Marston Bates and Jane Forsyth, a zero-weather trip under the leadership of The Swamp Stompers explored ancient beach ridges, moraines, relict biotic communities, and changing land-use in northern Ohio.

Natural areas for schools were stressed in business meetings.

JOHN W. BRAINERD, *President*

Sigma Delta Epsilon (X6)

At the luncheon sponsored by Sigma Delta Epsilon (graduate women's scientific fraternity for all women in

science) the featured speakers reported on research in two fields of science. Sister M. Angelice Seibert (Ursuline College) discussed her investigation of the interaction of mercury compounds and EDTA, and emphasized the biological importance of the mechanism involved. Agnes Hansen (University of Minnesota) reported on her long-term study of the atmospheric pollen counts in Minnesota. These data have made it possible for her to advise vacationists who were seeking an area free of ragweed pollen during the hayfever season.

The 1963 recipients of the three Sigma Delta Epsilon grants-in-aid were announced: Amegda Jack Overman (Gulf Coast Experiment Station), Sister M. Angelice Seibert, and Ruth Angelina Walker (Hunter College).

The dinner and Grand Chapter meeting of the fraternity were held in the Lewis Room of the Sheraton-Cleveland Hotel on 29 December. National honorary membership in Sigma Delta Epsilon was awarded to Margaret Mead (American Museum of Natural History), Mary I. Bunting (Radcliffe College), Agnes Chase (Smithsonian Institution), and Zada M. Cooper (Iowa State University).

At the business session which followed, great interest in the affairs of the freternity was demonstrated by suggestions and approved actions relative to membership, awards, communication, district conferences, and national meetings. A workshop, earlier in the day, facilitated the action on the various issues. Finally, the delegates elected the national officers for 1964: Sue C. Stevens, president; Agnes Hansen, 1st vice president; Eltora Schroeder, 2nd vice president; Hazeltene Parmenter, secretary; and Barbara Roth, treasurer.

SUE C. STEVENS, *President*

AAAS Symposia

Committee on Desert and Arid Zones Research

A symposium, "Arid lands of Latin America," provided a wide coverage of arid land problems and various suggestions for solutions. All of the speakers gave evidence of their intimate knowledge of Latin American conditions. The first papers dealt with climate, soils, and vegetation, and provided a background for the following discus-

sions on social and economic aspects. Papers relating to Mexico covered the anthropological background and the recent land reform programs in northwestern Mexico. Discussions on other Latin American areas showed how people in northeastern Brazil have solved some of their own problems, and contrasting views were presented on the possible solution to land use problems in Peru. Also noted were investment criteria for development of arid zones. The meeting was closed by a summary report on the Latin American Arid Lands Meeting held last September in Buenos Aires. It is hoped that the papers can be published in Spanish, but final arrangements have not yet been completed.

W. G. McGINNIES, *Program Chairman*

Radical-Ions and the Excited State

As part of the 1963 AAAS annual meeting in Cleveland, the Chemistry Section presented two symposia, entitled "Chemistry of radical-ions" and "Chemistry of the excited state."

The symposium on Friday (28 Dec.) was concerned with the generation, properties, and reactions of radical-ions, those species possessing both an unpaired electron and a charge. W. F. Libby (U.C.L.A.) discussed some of the properties of $CH_4^{+\cdot}$ generated by ejection of an electron from neutral methane by ionizing radiation. Libby suggested that insight into the chemistry of radical-cations could be obtained by considering them in terms of their isoelectronic counterparts. On this basis, $CH_4^{+\cdot}$ may be compared to the fluorine atom:

$$F\cdot + CH_4 \longrightarrow HF + CH_3\cdot$$

$$CH_4^{+\cdot} + CH_4 \longrightarrow CH_5^{+} + CH_3\cdot$$

Although CH_5^+ was reported by Russian workers in 1952, its existence gained only slow acceptance. Its formation, according to the foregoing equation, is one of the fastest reactions known. There are at least three effects of the positive charge on radicals: (i) Energy enhancement. In the molecule NeH^+ produced from $Ne^{+\cdot} + H_2 \longrightarrow NeH^+ + H\cdot$ the bond strength of the Ne-H bond is approximately 170 kcal. (ii) Polarization attraction. The positive charge induces a dipole in neutral molecules and thereby produces a very high capture cross section and very fast reactions. (iii) Charge exchange bonding. This phenomenon represented by

the reaction $CH_4^{+}\cdot + CH_4 \longrightarrow C_2H_5^{+}\cdot$ requires geometrical identity of the two moieties and can occur only in the condensed phase in molecules of any complexity. In contrast to the sensitivity of aliphatic compounds toward ionizing radiation and the great reactivity of the radical cations so produced, benzene and other aromatic compounds are inert. In $C_6H_6^{+}$ the charge is effectively delocalized. In connection with his work with benzene, Libby reported an impurity of less than 10^{-9} g/g in the preparation of high purity benzene.

Reactions of alkanes at low pressures as observed in a mass spectrometer were described by M. S. B. Munson, J. L. Franklin, and F. H. Field (Humble Oil, Baytown, Texas). The rate constants are independent of temperature, and therefore activation energies are essentially zero. From methane and ethane the protonated species CH_5 and $C_2H_7^{+}$ were observed; however, this did not occur in the case of higher members of the series (propane, butane, and isobutane). The main reactions of the alkanes observed could be considered as hydride-ion abstractions leading to $(C_n\ H_{2n+1})^{+}$ ions.

T. F. Williams (University of Tennessee) noted the effect of radical-ions in polymerization reactions in the condensed phase. Cyclopentadiene, which undergoes a conventional acid-catalyzed polymerization, also polymerizes on irradiation with cobalt-60 γ-rays at −78°C. The presence of a suitable base (for example, NH_3) to the extent of 0.01 percent (mole) reduces the polymer yield by over a hundred fold. The effect is attributed to neutralization of the growing polymer chain.

A detailed study indicated a low efficiency in the yield of ions responsible for initiation. These were characterized as positive radical-ions separated from their conjugate electrons beyond the range (200 Å) where the electrostatic attraction exceeds kT. The lifetime of polymerizing species are deduced to be about 10^{-3} sec implying rate constants for polymerization of 10^{7} liters mole^{-1} sec^{-1}. Because radical cations may be regarded as protonated radicals, for example, $CH_3\cdot + H^{+} \longrightarrow CH_4^{+}\cdot$, it was suggested that neutral free radicals generated by conventional chemical methods might display enhanced reactivity in very acidic media.

The radical-cations discussed previously are of short life. In contrast, radical-anions derived by electron transfer from an alkali metal atom to an aro-

matic olefin are stable almost indefinitely. M. Szwarc (State University, Syracuse) described such adducts from styrene, α-methylstyrene, and 1,1-diphenylethylene. The initially formed anion $M^{-}\cdot$, may dimerize to the dianion, $^{-}MM^{-}$, or react with monomer forming the dimeric radical-ion, $^{-}MM\cdot$. Various techniques were described which permitted study of the kinetics and equilibria in the two processes. These involved exchange between deuterated and nondeuterated dimers, exchange between a dimer and its radioactive monomer, and electron transfer from dimer to aromatic hydrocarbons such as anthracene or pyrene.

From naphthalene-alkali metal adducts D. Lipkin (Washington University, St. Louis) described new synthetic applications. Reaction with 1,4-dichloroalkanes yielded ring systems at the 1,2 and 1,4 positions of the naphthalene. New polycyclic structures are thus available by this method.

S. Weissman (Washington University, St. Louis) noted important data concerning radical-anions obtained from magnetic resonance spectroscopy: (i) average spin distributions, (ii) rates of intramolecular electron migrations, (iii) rates of intermolecular processes, and (iv) rates and equilibria of ion pairing.

Spectroscopic evidence for the formation of radical-ions by adsorption onto surfaces of heterogeneous catalysts (for example, silica-alumina) was reviewed by H. P. Leftin (M. W. Kellogg Co., Jersey City).

The symposium held on Monday (30 Dec.) reflected a renewed interest in photochemistry and emphasized chemistry of the excited state. G. Porter (Sheffield University), the keynote speaker, stressed the contribution of new experimental techniques. Matrix stabilization methods eliminate bimolecular reactions, such as radiationless processes, and true unimolecular decay rates can be obtained. Flash photolysis permits observation of primary products; over 100 different radicals have been observed by this technique which also permits the observation of triplet-triplet absorption. The lifetime of the triplet state is on the order of 200–300 μ sec. The flash photolysis technique permits a determination whether the reaction mechanism involves triplet or singlet states. Where the triplet itself cannot be observed, provision for energy transfer to an acceptor molecule, which has a lower-lying triplet but a much higher singlet, may be made. The

singlet state is much more reactive and shorter-lived than the triplet. In the n-π^* transition, polarization is responsible for the high reactivity of the resulting singlet state; this is in contrast to the π-π^* transition which does not result in polarization. Most bond dissociations are of the singlet type. The weakest bond of a polyatomic molecule will generally be broken in the gas phase; this is not the case in the condensed phase because of the cage effect. Here, the bond having the lowest activation energy for rupture is most likely to be dissociated. In concluding Porter pointed out that most chemistry to date represents that of the one-ground state; in contrast, with several excited states available, a much vaster field has been opened by excited state chemistry.

N. C. Yang (University of Chicago) discussed the photochemistry of carbonyl compounds involving intramolecular reactions. Singlet-state processes are best studied in this way because the singlets are short-lived states and because rates are not diffusion controlled for intramolecular reactions. Ultraviolet irradiation of ketones at appropriate wavelength causes $n \longrightarrow \pi^*$ transitions; the oxygen atom becomes more positive in the process and may abstract a hydrogen atom, thus forming a cyclic compound. The fact that the reaction is not an entirely concerted mechanism is shown by two facts: (i) When the carbon atom γ to the carbonyl is optically active, only about 15 to 20 percent of the optical activity is retained in the product. (ii) When the γ position permits allylic isomerization, both 4- and 6-membered ring products are formed.

The *cis-trans* photoisomerization of stilbene was discussed by J. Saltiel and G. Hammond (California Institute of Technology). The reaction occurred in the presence of an added sensitizer (with appropriate filters) which produces a high yield of triplet whereby energy transfer took place from the sensitizer triplet state (donor) to the stilbene ground state (acceptor). With a variety of sensitizers, whenever the ground-state singlet to triplet transition of the sensitizer was higher than the energy of the corresponding transitions of either the *cis* or *trans* isomers, the same *cis*-to-*trans* ratio was obtained in the photostationary state. With sensitizers of lower excitation energies the *cis*-to-*trans* ratio was a complex function of the energy and could be varied greatly.

IRVING MADOR, *Program Chairman*

Degenerate Stars

Properties of degenerate stars were discussed in a symposium as a part of the annual AAAS meeting held in Cleveland Ohio, 26–31 December. This symposium was organized and chaired by Hong-Yee Chiu (Goddard Institute for Space Studies) at the request of Frank B. Wood (secretary of Section D; University of Pennsylvania).

Charles W. Misner (University of Maryland) first summarized the theoretical aspects. Degenerate stars are cold stars in which the pressure is entirely due to degenerate electrons or neutrons and hyperons. It is well known that a mass limit, the Chandrasekhar critical mass (about 1.4 solar mass), exists for nonrelativistic degenerate stars. No equilibrium configurations exist when the mass exceeds this limit. White dwarf stars are one type of degenerate star in which the pressure is entirely due to the electron gas. The density is around 10^6 g/cm^3. However, if the density is increased to around 10^9 g/cm^3 (which is possible during the collapse of a star) inverse beta reactions will drastically reduce the number of electrons; as a result all nuclei dissolve into free neutrons. Because the inverse beta reaction induces an instability, no star exists with a density from 10^8 to 10^{13} g/cm^3. At a density of 10^{14} g/cm^3, inverse beta reaction is complete and a stable region is obtained. However, at this density the mass concentration is so high that general relativistic effects should be included in the study of the theoretical structure. The significant contribution is that the pressure (stress energy) now also contributes to the energy, which is the source of the gravitational field. The critical mass is now reduced to around 0.7 solar mass. H. Zapolsky's recent work indicates that the most extreme assumptions on the equation of state (postulated to increase the pressure) only decreases this critical mass limit to 0.3 solar mass.

A. G. W. Cameron (Goddard Institute for Space Studies) discussed the composition of matter at extreme densities. Almost all hyperons are produced in an equilibrium state. Recent results from nuclear many-body theory were used to obtain an equation of state. The limiting mass does not seem to change by much. He also discussed the possible surface composition (collaborator, Miss S. Tsuruta) at somewhat lower densities (about 10^9 g/cm^3 or less). Two groups of elements ap-

pear to be stable; one is the iron group elements (mass number A about 56) and the other is the neutron-rich group elements (A about 80). The surface of a neutron star is thought to be composed of these two groups of elements.

The two theoretical papers, which dealt mainly with neutron stars because the internal structure of the ordinary white dwarf star is well understood, were followed by two papers on the observational aspects of white dwarf stars. Neutron stars are expected to radiate mainly in the x-ray band. Recent rocket x-ray experiments by Friedman (Naval Research Laboratory) indicated that there are discrete x-ray sources coincident with known supernova remnants. The source might be neutron stars. V. Weidemann (Physikalisch-Technische Bundesanstalt) discussed the structure of white dwarf atmospheres. The atmosphere of a white dwarf star is only 100 meters thick, with a surface gravity of 10^8 cm/sec^2. The lines are extremely broadened by high gravity and density. The width of these lines is around 100 Å (as compared to the gravitational red shift which is of the order of 10 Å). In general, one can divide white dwarf stars into two groups, the hydrogen-rich and hydrogen-poor atmospheres. In one type of white dwarf star (DC) no line is observed. In the determination of the color of the star (and hence its surface temperature) the great variation of surface composition must be taken into account. In general, the white dwarf radiation more closely resembles black body radiation than that from an ordinary star.

J. B. Oke (Mt. Wilson and Palomar observatories) reported on the observational aspects of white dwarf stars. Most of the earlier work was done by J. Greenstein (Palomar Observatory). White dwarf stars are intrinsically fainter than the sun by a factor of 10^3 or more. The brightest white dwarf star (the companion of Sirius A) has a magnitude of 10. Usually one has to work with white dwarfs of magnitude +15 and at this brightness it is not possible to use high dispersion spectra graph. On the other hand, the spectra lines are usually broadened and do not contain any finer detail. With a 200-inch telescope, the limiting distance is around 100 parsecs. Photomultiplier devices are now used in the study of white dwarf spectra and give higher sensitivity and better signal-to-noise ratio than photographic plates.

In the future it is hoped that an array of 50 photomultipliers may be used, with each recording a part of the spectra. This will drastically reduce the observation time. From the observations and theoretical interpretation of white dwarf stars, one can obtain vital information regarding the mass, density, surface temperature, and eventually, evolution track. Most white dwarf stars have a surface gravity of 10^8 cm/sec^2. From this and the theoretical radius-mass relation, one can conclude that the average mass is 0.5 solar mass and the radius about 1/70 of the radius of the sun. Although it is not possible to determine the mean molecular weight accurately at present, results indicate this may be achieved with better observational equipment and with better model atmospheres for white dwarfs.

HONG-YEE CHIU, *Program Arranger*

Growth and Development of the Face, Teeth, and Jaws

The growth and development of the face, teeth, and jaws and future research in this field were the subjects of a four-session symposium sponsored jointly by the Dentistry Section (Nd) and the Section on Anthropology (H) at the annual meeting of the AAAS in Cleveland, Ohio (26–27 December).

Paul E. Boyle (chairman of Section Nd) opened the sessions and welcomed the audience. Albert A. Dahlberg (University of Chicago) emphasized the variations in types and sizes of dento-facial structures and noted the processes involved in evolutionary change. In a discussion on normal variations in dento-facial growth, Coenraad Moorrees (Forsyth Dental Center) stressed the importance of directing future research toward a better understanding of factors that contribute to individual differences (source of variants).

More emphasis than ever before was placed on the extent of genetical involvement in dental facial growth, and the discussions to a degree were far removed from conventional, historical analyses. Harold O. Goodman (Bowman Gray School of Medicine, Winston-Salem) carefully scrutinized the present literature and indicated that much past information on the inheritance of dental and facial parameters, and in particular, modes of inheritance of specific dental defects need more adequate testing, and in many cases,

confirmation. Uwe Stave (Fels Research Institute) detailed the interaction of genetic and environmental factors in dental and facial malformation, and noted the extent to which susceptibilities to environmental insults were, in part, genetically determined. Developmental defects with associated facial disturbances were discussed by Frederic N. Silverman (Children's Hospital Research Foundation, Cincinnati). He also presented an illustrated series of cases, including arrhinencephaly and trigonocephaly.

Discussions by M. Michael Cohen and R. A. Winer (Tufts), Tatsuo Fukahara (University of Chicago and Tokyo University School of Dentistry), and Robert J. Gorlin (University of Minnesota) indicated the increasing evidence for dental and facial defects in chromosomal abberations, deletions, reduplications, and translocations. In particular, Gorlin traced changes in palatal height and arch width from the (naploid) XO (Turner's syndrome), the XX, the XXX, the XXY, the XXXY, and so forth. Reacting as if a timing mechanism were involved, palatal height and arch breadth alter with the amount of X chromosomal material held in common. Fukahara noted the extent to which siblings of children afflicted with cleft palate were characterized by minor cephalo-facial disturbances; this fact is clearly suggestive of the carrier state and was originally suggested by Neel (Volume 1, Number 1, *American Journal of Human Genetics*). In this connection also, Daris R. Swindler and Harriet Ann McCoy (Medical College of South Carolina, Charleston) demonstrated that the type of polymorphism in tooth sequence existing in colony-reared rhesus monkeys was the same as that found in family studies of normal children from southwestern Ohio. From this and other observations it was suggested that primates as a group (specific primate species and sub-species) possess many genes in common that affect dental and facial development.

Discussions in the final session extended many of the ideas presented in previous sessions and also suggested new lines and directions of research. Panel members (Richard C. Greulich, University of California; Jerry D. Niswander, National Institute of Dental Research; Wilton M. Krogman, University of Pennsylvania; Edward E. Hunt, Jr., Harvard University; and Robert E. Moyers, University of Mich-

igan) generally agreed that there must be a critical reexamination of old and prevailing concepts; exploration of new concepts of control mechanisms of growth, with particular regard to aspects of canalization or buffering of growth; additional studies at the molecular level. Also emphasized was that advances in knowledge of malformations and normal growth, while dependent upon a better understanding of molecular genetics, can be furthered by explaining the complicated interactions between environmental agents and associated complex, multiple, hereditary factors. In addition, there is great need for further defining the factors with the capacity for controlling cell proliferation and differentiation.

Publication of the proceedings of this conference will be aided by a grant from the National Institutes of Dental Health and will be distributed as a special supplement to the *Journal of Dental Research*; it will include contributions from E. Holly Broadbent, Carl J. Witkop, and Seymour Kreshover. The arrangers for the overall program were Stanley M. Garn and Sholom Pearlman (American Dental Association) and the sponsors included the AAAS section on Anthropology (H), American Dental Association, International Association for Dental Research (North American Division), and the American College of Dentists.

SEYMOUR J. KRESHOVER, *Secretary*
STANLEY M. GARN, *Program Arranger*

Science Research Planning: Instruments and Equipment Use

The programs of the conference were jointly sponsored by the Office of Economic and Statistical Studies of the National Science Foundation and by the Industrial Science Section (P). The morning session was concerned with the role of instrumentation and equipment use in science research program planning: the afternoon session was more broadly oriented to the planning and management of science research programs.

The introductory paper by Zola Bronson (National Science Foundation) addressed itself to two major aspects of the role of instruments and equipment use in science research program planning—development of a preliminary estimate of present R&D dollar expenditures for instrumentation in

support of R&D programs and the nontechnical impacts of instrumentation on R&D planning and management, largely due to the cost, complexity, and associated characteristics of instrumentation. These impacts are seldom consciously recognized by R&D planners and managers.

For 1963, a variety of data resources cited suggests an expenditure on the order of $4- to $4.25-billion for instrumentation acquisition and use out of an estimated $16-billion R&D expenditure. This includes instruments themselves and all other devices, components, materials, and supplies which will help make up an operative instrument system, including electronic computers. Further, as the result of a variety of management policies and practices now operating in the R&D laboratory, an estimated total of $25- to $30-billion of instrumentation materials, based on original acquisition costs, may be on hand in the nation's laboratories despite noticeably low use level for much of the available instrumentation. Increased annual expenditures are anticipated so long as total R&D expenditures continue to rise. A leveling off of R&D expenditures, with an overall tightening of available funds, however, could be accomplished by a sharper drop in the level of instrumentation expenditures. Further, the normal tooling up characteristics of instrumentation and the existing excess capacity of many facilities could contribute to a reduced expenditure ratio in the future.

Preliminary studies show that freedom of research for both the researcher and management is impaired by the decision to exclude from formal consideration those research projects believed to involve significant expenditures for instrumentation or where ready access to instrumentation is uncertain. Although instrumentation of R&D, in the aggregate, may generate increased overall manpower requirements, intermediate phases of technological displacement and obsolescence of scientists, engineers, and technicians also exist; this situation is comparable to the impact of automation on the production work force. The low levels of instrumentation use in the laboratory, concurrent with the acquistion of additional units of identical or comparable R&D instrumentation resources, require re-examination by R&D planning and management. The urgency of this issue is underlined by the huge in-

ventory of instrumentation facilities now on hand in the nation's laboratories, the increasing concern about the rising cost of R&D, and the view that researchers need to be humored and allowed to be possessive about instrumentation supplied to them. The extent to which these conditions are a measure of R&D affluence and the American's proclivity for gadgets is also at issue.

Optimization of the promise of R&D instrumentation for catalyzing the researcher's creativity, as well as his productivity, is another planning and management responsibility. The hazards of producing overwhelming burdens of data, impeding research productivity, and drowning potential creativity in the absence of specially qualified supporting manpower to assure effective instrumentation utilization are included with a number of other nontechnical aspects of R&D instrumentation for which more thoughtful research program planning and management is required. Before more effective performance by the latter can be anticipated, however, better record-keeping on instrumentation acquisition costs, use levels, manpower impacts, and associated issues is essential.

Despite the significantly increased costs for certain categories of R&D instrumentation, Winston E. Kock (Benedix Corporation) expressed the view that without this instrumentation, costs of research would be even higher, if not completely unattainable. This relatively lower cost, of course, is due to the increased productivity attained and to this extent is bridging the manpower shortage gap. Unfortunately, the manpower shortages and limitations are so great that even more extensive development and use of newer and better instrumentation are essential. As a result of this inter-linkage, Kock is of the opinion that future research growth will become increasingly dependent upon more and better instrumentation; and significant incremental increases in creativity due to improved instrumentation are anticipated. The latter will be due to the resulting reduction in time required for investigations, permitting more ideas to be conceived and explored.

The pervasiveness of increasing complexity of instrumentation has not, however, entirely eliminated the beeswax and string scientist. The moral to be learned from the latter, according to Kock, is the beneficial ingenuity of

the experimental design which sparing access to instrumentation makes possible. Continued performance under these conditions often further enhances the researcher's ingenuity. Also, the unplanned and unmanaged use of extensive instrumentation impairs the development of the researcher's ingenuity and the law of experimental simplicity, thus making the experimentalist a less effective idea man.

Discussing instrumentation acquisition and use policies from an industry point of view, John Grebe (The Dow Chemical Company) expressed the opinion that broad policies for the acquisition and use of instrumentation in new laboratories today, as contrasted with 10 years ago, is roughly the same in all sectors. The differences are primarily in the replacement and rejuvenation policies. With reference to the expenditure requirements for laboratory instrumentation, Grebe pointed out that whereas in the process industries control instrumentation accounts for approximately 20 percent of the total capital expenditures, in the modern laboratory it is more nearly a 1 to 1 ratio. Large as this may seem, Grebe is of the opinion that it is small to those who know how much more could be accomplished if still further instrumentation is applied.

A significant difference in laboratory operations, particularly as regards instrumentation acquisition and use in government compared to industry, is attributed to antiquated government regulations and specifications which permit or encourage older methods to persist. Wherever government specifications are followed, one cannot help but recognize long lags between the initiation and standardization of technology. It becomes so difficult to make changes and corrections or to go to very new systems of detection or control. Comparable conditions were found in the universities, because of the difficulty of getting funds for new facilities. The resultant lag in the teaching of undergraduates of as much as 20 to 30 years, leaves an imprint on their mental attitude that is hard to erase when they get into positions of authority.

In the concluding paper, Otto Schmitt (University of Minnesota) observed that the insidious changes in the nature of R&D instrumentation during the past decade have left a national pattern of policies with respect to development of new instrumentation ac-

quisition and utilization that is at best a patchwork of well-intentioned efforts to stimulate the present rapid advance of science and at the same time to demonstrate concern with fiscal and scientific responsibility. A higher rate of scientific growth and productivity could be achieved at a lower cost in dollars, elapsed time, and frustration, if key policies are reframed to conform to the real human needs of the individuals and organizations involved. Policy changes to meet future instrumentation impacts include: (i) anticipating, at least in general outline, the way that instrumentation will go over the next few years and establishing a policy that will be appropriate when it goes into operation; (ii) developing inter-compatible instrumentation, because we cannot afford the engineering costs of a special instrumental development for each need; and (iii) modification of instrumentation acquisition policy to conform to the systems concept instead of its present focus on the instrument component.

Schmitt pleaded for as much managerial concern over the efficiency of idea production and use as is currently exhibited with regard to the more material and tangible inputs in research. Regarding the existing low use level of instrumentation, he proposed that idea-generating experimental scientists be pampered with instrumentation that will be used only occasionally and with personal and departmental computers that will be idle 80 to 90 percent of the time, as are their corresponding personal and departmental libraries and shops. Investment in additional instrumentation available to a smaller, select group of experimental scientists is considered likely to be more productive of useful ideas than more staff employed at the expense of instrumentation acquisition. The large inventory and existing high levels of fund expenditures for R&D instrumentation is believed to be due at least in part to two operating policies. First is the ever-recurring complaint over the length of time required to negotiate approval of proposed instrumentation purchase and the consequent practice of acquiring devices before actually needed or before the specific capabilities have been adequately identified. Second is the hesitancy on the part of federal agencies particularly, to reclaim semi-obsolescent instruments, especially if the ill will of an investigator may be incurred in the process. Conversely, the

experimental investigator encounters endless difficulty in trying to dispose of unneeded instruments. J. F. Reintjes (M.I.T.) served as chairman.

The papers presented at the session on the planning and management of science research programs, consisting of two each from the respective sectors of government, industry, and the university, were concerned with the factors affecting the optimum utilization of human and material resources in the performance of science research. Despite the different orientation of the respective sectors, the papers demonstrated an underlying identity of responsibility for basic issues. Perhaps most significant, however, were the contrasting policies and practices with regard to the basic issues, as expressed by the representatives from the same sector. These differing viewpoints underscore the importance of recognizing that in the non-technical areas of science research planning and management, identical issues may be subject to equally satisfactory solution in more than one way. The critical consideration is that any proposed guiding policy or operating procedure be based on an accurate identification of the essential elements in the issue to be resolved.

Ralph A. Sawyer (University of Michigan) viewed the campus research administrator's basic responsibility as one of helping establish policies concerning research, monitoring research to assure conformance with policy, and providing support services to research directors. Project research justification, planning, staffing, and management are viewed as concerns and responsibilities of the research sponsor and the officers and committees that guide the programs of the various university departments.

In the paper prepared by John R. Dunning (Columbia University), and read in his absence by Lawrence H. O'Neill, the university was called upon to accept responsibility and leadership in dropping the false dichotomy between the teaching and research functions. This dichotomy is charged with serving as an excuse for avoiding the big and speculative research in favor of cautious projects more certain to result in publications. The latter does not have the boldness of conception expected in the free environment of the universities.

Erwin G. Somogyi (Somogyi Associates), representing industry, identified the rapidly changing research picture

as the cause of the difficulties in increasing the yield from the present industrial research effort. To resolve this condition. Somagyi emphasized the need to base the management approach, at least in part, on unchanging factors. These are the human aspects which involve a process of motivation and consist of three major steps: (i) Setting goals and standards, (ii) management and evaluation of performance, and (iii) response to the performer.

William B. Reynolds (General Mills) emphasized the profit requirement as the dominant concern of the industrial sector in R&D. Accordingly, industrial research planning and management must give priority consideration to product marketing factors. Further, consumer-oriented research involves factors of corporate relations not usually involved in process research or in the development of industrial end items. This necessitates a finely balanced cooperation between research and marketing management, since both are responsible for the ultimate success of the research effort. The research administrator in this industry group must organize the research functions so that product concepts flow from technology itself, requiring the creation of an environment in the research organization where all echelons are highly motivated to product innovation.

In discussing the planning and management of research from the viewpoint of the government sector, Nicholas E. Golovin (Office of the Science Advisor to the President) focused his attention on basic research. He believes that pressures for the detailed planning of research will continue despite the fact that basic research particularly, does not readily lend itself to conventional planning techniques, except in very transient and trivial ways. At the same time, the researcher, as a matter of self interest, needs to facilitate a broad understanding of the nature and methods of science and technology and their roles in society. Golovin suggests emphasis on procedures which will produce coordination and integration before agency plans and budgets are formulated, depending on systematic and detailed information exchanges between agencies having R&D efforts in the same or related fields. Making government employment more attractive for outstanding scientists and engineers will help reduce existing obstacles to "coordination." Additionally the availability of scientists and engi-

neers within the legislative and executive branches of government would facilitate the optimum exploitation of science and technology for social progress. A first and major step towards significant progress to the problem of coordinating R&D at the national level was described as the abandonment of the futile search for general solutions and the substitution of gradual, gently directed evolutionary efforts.

In the concluding paper, T. C. Byerly (U.S. Department of Agriculture) observed that the purpose of science administration and management in the executive agencies is to maximize the quantity, relevance, and rate of research productivity of federal funds appropriated for research. Further, because the faith of American scientists in research management is thin, they subscribe to the proposition that all management and administration are nuisances. Tradition, however, has always required that the science manager be a scientist, and this raises the question whether this is the best use of the scientist's time. Byerly questions whether "amateurs in management," (for example, scientists turned managers) provide sounder judgments than professionals in management. Likewise, he is uncertain that the use of panels of scientists meets the existing needs and he wonders about the number of scientists who now serve on panels to review project proposals. The latter raises the further question of whether the advisory service of the panel members is more valuable than what they would accomplish with the same hours in actual research in their own laboratories. In this regard and related matters, Byerly questioned the validity of the manpower shortage appraisals.

In conclusion, Byerly noted that research management is necessary to maintain quantity, relevance, and rate of research productivity. Government research laboratories should operate either in conjunction with universities or be of sufficient size to assure continuing communication with the scientific community on a reciprocal basis. Freedom of research choice varies more within universities, industry, and government than it does among these three groups. Non-scientist administrators have difficulty gaining the cooperation of research personnel largely due to communication failure and prejudice on both sides. Jacob Perlman (National Science Foundation) served as chairman.

ZOLA BRONSON, *Program Arranger*