gram copy and who also worked long, hard, and cheerfully in the AAAS Office.

Prizes and Awards

The following is a listing of prizes and awards presented during the 132nd AAAS annual meeting.

Newcomb Cleveland Prize—John Papaconstantinou, Institute of Cellular Biology, University of Connecticut, for his paper, "Protein and nucleic acid changes in the differentiation of lens cells" read before the section on Medical Sciences (N), 29 December 1964, as a part of the symposium, "Biochemical Differentiation."

AAAS-Westinghouse Science Writing Awards—William Hines, science writer, Washington *Evening Star*, for a series of articles on the Mariner IV flight to Mars; and Lawrence Lessing, associate editor, *Fortune*, for his story, "Solving the riddle of the shuddering earth" in the February 1965 issue [*Science* **150**, 3703 (1965)].

(No *AAAS Socio-Psychological Prize* was given in 1965.)

Industrial Science Achievement Award—Presented by the AAAS Industrial Science Section (P) to Stanford University.

William Procter Prize—To Col. W. H. Pickering, director, Jet Propulsion Lab, California Institute of Technology, in recognition of his notable accomplishment in space science research. The award was presented at a combined luncheon meeting of the Society of the Sigma Xi and the Scientific Research Society of America. The award was made by the latter.

Conclusion

The 132nd meeting of the Association officially ended with the adjournment of the last session—the annual illustrated lecture of the National Geographic Society—but in other ways its termination is delayed for weeks. Even the payment of the last bill, the writing of the last letter connected with it, the appearance of the reports about it—none of these entirely ends the meeting. Scattered inquiries about specific papers will come in from all parts of the world for years to come. (To all such requests, we must say please write the author directly, because the press-room files are exhausted.)

The greatest impact of the meeting is on the young men and women who are stimulated to continue their work. In some cases, the direction of their research may be changed as the result of hearing a symposium paper or discussing a problem with a colleague. In retrospect, it will be seen that the Fourth Berkeley Meeting has made its contribution toward the general advancement of science.

Note

1. Detailed proceedings were discontinued after 1909 when *Science*, the official journal of the AAAS, began to publish reports about the meeting, throughout the year. *Summarized Proceedings*, covering several consecutive meetings and including a current directory of members, appeared at intervals from 1910 through 1948. After that centennial year, *Science* has had an annual proceedings issue in mid-February.

Reports of Sections and Societies

General Sessions

Behavior, Brain, and Biochemistry

The two-day, "3-B" symposium on Behavior, Brain and Biochemistry (27-28 December 1965) brought together one of the widest scientific representations of the AAAS meetings with geneticists, anatomists, biochemists, physiologists, pharmacologists, neurologists, and psychologists from 22 institutions. The sessions were attended by an audience of approximately 2000.

The papers described some striking achievements of this new interdisciplinary science of behavior and brain. Among these were experiments suggesting that drugs may already be available to control memory and learning; that brain RNA may be intimately involved in the biochemical substrate of mental life; and that the anatomy and chemistry of the brain, and the learning ability of the individual can be changed by the psychological richness of the environment.

As illustrative of the first theme were the papers read by B. W. Agranoff (University of Michigan), A. J. Glasky and N. Plotnikoff (Abbott Laboratories), and L. Petrinovich (State University of New York at Stony Brook). Agranoff noted that puromycin and other agents inhibiting protein synthesis could effectively "erase" recently acquired experience (in goldfish), and thus prevent the consolidation of short-term memories into enduring ones. Glasky and Plotnikoff presented two papers. One gave an account of the biochemical effects and the other described the behavioral effects of a magnesium salt of 2 imino-5-phenyl-4-oxazolidinone. This drug, registered under the trade name of "Cylert," increases brain RNA synthesis and improves memory for an acquired avoidance response in rats. (Discussion at the meeting brought out the further information that this agent is already being clinically tested with hospitalized senility patients in the hope of alleviating memory loss typical of such patients.) Finally, Petrinovich reviewed his and McGaugh's experiments and presented additional data in support of their conclusions that strychnine, when given in proper dosages, can improve the learning performance of rats.

The second theme was not only apparent in the Abbott papers, but was also exemplified in the work of J. Zemp, J. Wilson, K. Schlesinger, and E. Glassman (University of North Carolina) where large and significant increases in brain RNA were observed after conditioned avoidance training in the mouse.

E. L. Bennett reported on the work of the Berkeley group—one of the first

to initiate studies about 14 years ago on behavior and brain chemistry. His paper described three sets of experiments showing that (i) a psychologically enriched environment increases the growth of the cortex of the brain, increases its blood supply, its number of glia cells, and its enzymatic activity; (ii) that this kind of environment also improves the learning ability of the animal; and (iii) that there exists a significant relation between enzymatic activities in the brain and learning ability.

Some observers concluded from this and other corroborative work that a culturally deprived environment may produce human children with deficient brains just as surely as an inadequate diet may produce other deficiency effects.

DAVID KRECH, *Program Arranger*

Mathematics (A)

"The new mathematics" was both the subject of a symposium and a topic in the vice-presidential address "Where is mathematics going?" by Bernard Friedman. Defending the fundamental power of newer abstract methods, Friedman nevertheless noted the extensive criticism of the preparation by mathematics departments of students for problem-solving, working environments. He used the history of the development of groups to illustrate the time variation of the concepts of abstractness and applicability, and observed that "physicists will say any day now that 'the world is made up of irreducible representations of groups.' "

The report in "The new mathematics" symposium on some of the work of the School Mathematics Study Group made clear that the second phase of the mathematics-education revolution will put greater emphasis on ideas coming from and applications of mathematics to the experimental sciences. The incorporation of principles of computer science and of mathematical physics in new textbooks on computing and calculus for the twelfth grade, and science experiments for junior high school were described. More philosophical in tone was Paul Rosenbloom's examination of the deeper connections between physical measurements and mathematics. Max Bieberman was unable to be present to describe the work of his group at the University of Illinois.

The American Mathematical Society met in conjunction with the AAAS for the first time in several years. An invited address on "Biharmonic boundary value problems" by T. M. Cherry (University of Melbourne) and five sessions of contributed papers comprised their program.

On-line computing was demonstrated by a scientist who sat at a console in Berkeley and used a computer at the Massachusetts Institute of Technology. A second and similar use of a computer in the same building impressively established the effectiveness of this new type of computing as a powerful scientific tool.

WALLACE GIVENS, *Secretary*

American Mathematical Society (A1)

The American Mathematical Society held its 629th meeting (29 December 1965) as a part of the annual meeting of the AAAS.

The principal feature of the meeting was an address by Sir Thomas Cherry. Cherry is an emeritus professor and senior research fellow from the University of Melbourne in Australia. He is a past president of the Australian Mathematical Society and the Australian Academy of Sciences. This year he is a visiting professor at the University of Washington. Cherry spoke on "Biharmonic boundary value problems." His talk covered several aspects of this important area of mathematics and included some of his own contributions on the subject.

A total of 33 mathematicians from universities throughout the country presented 10-minute talks on their recent discoveries. These short lectures were concerned with such fields as analytic function theory, approximation theory, convexity, differential equations, harmonic analysis, measure theory, recursive function theory, and universal algebras.

R. S. PIERCE, *Program Chairman*

Society for Industrial and Applied Mathematics (A5)

B. H. Colvin (Boeing Scientific Research Laboratories) presided at the session on "New applications in mathematics and their implications for mathematical education," and explained its purpose—to draw attention to new areas of mathematical application and to explore their implications for mathematical education, particularly at this time when there is a general climate for reform in mathematical education.

George B. Dantzig (University of California, Berkeley) discussed the effect that the combination of mathematics and the computer had made in the area of operations research or the science of decision-making. Striking results have been achieved through the use of mathematical programming to solve large-scale "deterministic" problems. On the other hand, in problems where uncertainty is present, such as occur in inventory theory, control theory, and traffic theory, success has been achieved, for the most part, in cases where the number of variables is small. Dantzig questioned whether industries, government, and universities were giving sufficient preparation to people who were to work in this area.

Victor Klee (University of Washington) gave examples of recent work in several areas of science which have led to the formulation of mathematical problems which are of great intuitive appeal, but which have resisted numerous attempts at solution. He suggested the introduction of such problems into mathematics courses (especially courses in "pure" mathematics) to expose students to the frontiers of mathematical knowledge, and to the fruitful interaction between pure and applied mathematics. Examples chosen were from graph theory and the geometry of convex bodies, which had their motivation from solid-state physics, classification of organic compounds, molecular genetics, botany, and information theory.

Leo Katz (Michigan State University) referred to the principal areas of social science, when ordered in terms of the underlying complexity of their mathematical structures. He used examples from the fields of economics, psychology, and sociology to illustrate different levels of mathematical abstraction and the difficulties that students had in dealing with mathematical concepts. As examples of the implications that work in the social sciences has for mathematical education, he stated that (i) social scientists need experience with more abstract mathematical structures; (ii) research workers need to acquire more analytic skills; (iii) there should be early at-

tention given to working with the notions of probability; and (iv) research workers require statistical methods to do inference, not just data collection.

The ensuing discussion period brought out the following ideas: greater emphasis on the subject of probability, courses whose content and pace were geared to the social scientists, a broadening of the concept of what constitutes mathematics, and a need for greater emphasis in course material on "nonlinear" problems.

JAMES H. GRIESMER,
Program Chairman

Physics (B)

The Physicists' Luncheon, held at the men's faculty club on 27 December 1965, was successful as usual, with 70 persons attending. The Section B vice-presidential address by Emilio G. Segrè, (Nobel laureate, University of California, Berkeley) was entitled "Physics in the last 20 years." He started back at around 1900 in order to put the many advances of modern physics into proper perspective. It is always interesting to hear evaluations of advances in physics by persons who have participated intimately and successfully in them; Segrè's speech was no exception. He noted as an outstanding scientific event of the last 20 years the prediction of the nonconservation of parity in weak nuclear interactions, and its subsequent experimental verification.

Matthew Sands (Stanford University Linear Accelerator Center; currently chairman of the Commission on College Physics) reviewed some of the many activities of that rather unusual group. His theme was: "Let's teach better physics!" He emphasized the new courses in college physics that are being developed on various campuses across the country, and he exhibited new textbooks already published or in preparation. These books represent a break, to a lesser or greater extent, from the conventional rhythm of physics teaching that has existed for over a century. Sands showed a short movie in color taken during a recent summer institute at the University of Washington, Seattle. This film was put together by design experts and artists as well as physicists, and it differs greatly from the conventional teaching film. Whereas some conservatives would regard these techniques as "far out," the audience recognized their value and their challenge.

Current problems in particle physics were reviewed and highlighted by Edwin M. McMillan (director, Lawrence Radiation Laboratory at Berkeley). He flashed back to 40 years ago when the basic nature and philosophy of particle physics was born with quantum mechanics and quantum field theory. He noted that quantum electrodynamics is still successful in treating electromagnetic interactions. He mentioned the weak and the strong interactions of nuclear physics and the new conservation laws that have been introduced in an effort to make some order out of the chaos resulting from the discovery of well over a hundred "elementary" particles—some of which, however, have very short lifetimes.

Harvey E. White (University of California, Berkeley) spoke in the new Physical Sciences Lecture Hall. The hall was built at a cost of almost a million dollars in order to accommodate large attendance at courses in physics and chemistry.

The lecture hall seats 550 and has several unusual features. One of these features is a rotating stage consisting of three 120° sectors. Thus, while one professor is teaching his course two others can be in the preparation room, out of sight and out of hearing, preparing demonstration lectures for the two following hours. With this arrangement the lecture hall can be used continuously all day and can handle a very large student load. Another unusual feature is the use of closed-loop television "so that the student in the back row sees as much as the one in the front row." One television camera is directed at the blackboard and relays its information by TV monitors to persons throughout the room. A second camera is directed toward one end of the demonstration bench, where experiments can be performed that by their very nature must be small in size—for example, Wilson cloud-chamber tracks. Again, these demonstrations can be seen by students regardless of their seating location.

White also discussed plans and progress on the Lawrence Hall of Science, of which he is the director. A large building under construction on the Berkeley hills above the Lawrence Radiation Laboratory will be the most modern laboratory for science teaching yet developed, and a fitting monument to Ernest O. Lawrence, great teacher and research physicist.

STANLEY S. BALLARD,
Secretary

Chemistry (C)

Non-Protein Neurotoxins

A symposium on Non-protein Neurotoxins (27 December 1965), arranged by Harry S. Mosher (Stanford University), included three invited speakers, each of whom discussed the chemistry of a different naturally occurring neurotoxin which had been isolated from an animal source.

Henry Rapoport (University of California, Berkeley) discussed *saxitoxin*, the shellfish poison; John Daly (National Institutes of Health) discussed *batrachotoxin*, a poison isolated from the skin of a South American frog and used by the Colombian Indians as an arrow poison for their blow gun darts; and Paul Scheuer (University of Hawaii) discussed *ciguateratoxin*, the causative agent of ciguatera poisoning which arises from eating a variety of poisonous fish largely from the Pacific atolls.

Certain shellfish periodically become poisonous to humans. This has been the reason for the often-quoted injunction against eating mussels and clams during those months which do not contain an "r." It is now known that the substance responsible is produced by a marine plankton, *Gonyaulax catenella*. At certain unpredictable times, these red plankton multiply so rapidly that they make the sea water appear colored, creating what is commonly known as the red tide. Although many fish may be killed by this red tide, mussels and clams survive but concentrate the toxic principle, thus becoming poisonous to humans. The chemical substance responsible, saxitoxin ($C_{10}H_{17}O_4N_7 \cdot 2HCl$), has been isolated from the Alaskan butter clam, California mussel, and *Gonyaulax catenella* by previous workers. Rapoport gave an account of the chemical studies he has carried out with his students to determine the structure of saxitoxin. A key degradation product was obtained by oxidation with hydrogen peroxide. This procedure was followed by reduction with phosphorus and hydrogen iodide to give a product, $C_9H_{12}O_2N_6$, containing nine of the original ten carbon atoms and all but one of the original seven nitrogen atoms of the parent toxin. The missing carbon and nitrogen atoms are accounted for by the formation of carbon dioxide and ammonia. This degradation product has been proven by degradation and synthesis to be 2-imino-8-amino-6-methyl-

3-β-carboxyethylpurine. Studies with deuterium isotopes have shown that an oxygen substituent must be located on the 6-methyl group in the original toxin. Thus the structure of saxitoxin would appear to be a reduced form of this degradation product carrying a substituent readily hydrolyzed to carbon dioxide and ammonia. One of the highlights of the symposium was the manner in which studies with oxygen and deuterium isotopes were used to advantage by Rapoport in his chemical studies.

John Daly reported his studies on the substance originally called kokoi venom but now named batrachotoxin. This venom is obtained from the skin of a small, poisonous frog, *Phyllobatus bicolor*, found in the jungles of South America. The poison obtained in crude form from these frogs is used by the native Chocó Indians to poison the tips of their blow gun arrows and is probably the most toxic non-protein substance known. It is said that one frog will produce enough poison for fifty arrows and that such an arrow can paralyze a variety of small game animals, such as monkeys, in a few minutes. From the skins of 2200 frogs there was obtained 30 mg of the crystalline batrachotoxin whose molecular formula was determined by high-resolution mass spectrometry to be $C_{24}H_{33}O_4N$. Investigations by mass spectrometry and nuclear magnetic resonance indicate that the substance has a steroid-like nucleus with one bridge-head methyl group, and two of the four oxygens, one nitrogen, and seven carbons which must form a unit. This, coupled with a positive test for a pyrrol nucleus on degradation, has suggested that the toxin contains a pyrroline ring incorporated in the molecule at some unknown position. More batrachotoxin must be obtained before the structure, as well as the pharmacology, can be worked out in detail. Thus, another expedition to Colombia to collect more poison arrow frogs is planned.

Ciguatera poisoning results from eating any one of a variety of fish widely distributed near the shores of the Pacific islands. The toxicity of a particular fish may vary with locale and with the season; probably the ultimate source of the poison is some marine plant material, as in the case of saxitoxin. Lack of a reliable source of toxic fish has been a great barrier to chemical studies.

Paul Scheuer has found ciguateratoxin in livers from both the shark and moray eel. He has been able to isolate, by chromatographic methods, material from each of these sources which appears homogeneous. Although these two substances seem to be the same pharmacologically, they have slightly different R_F values, and thus ciguateratoxin appears not to be a single substance but two, or perhaps more, closely related substances. The material is a light yellow, viscous, fat-like oil which, from the eel, has an empirical formula approximating $C_{28}H_{52}NO_5Cl$; it does not contain phosphorus. The material appears to contain at least two kinds of nitrogen. It is a quaternary ammonium compound, and a positive ninhydrin test can be obtained on hydrolysis. Thus, the molecular formula very likely is a multiple of the above empirical formula. The ciguateratoxin problem is now much closer to solution.

These three substances, saxitoxin, batrachotoxin, and ciguateratoxin, constitute three most interesting but still incomplete problems in the realm of neurotoxins. These three progress reports were, in each case, highly encouraging for ultimate elucidation of the structures.

HARRY S. MOSHER,
Program Arranger

Recent Developments in the Study of Energy Transfer

Among the most exciting developments of the decade has been the beginning of an understanding of chemical reactions on the molecular level. A part of this understanding is connected with the study of energy movement: within molecules, between molecules, and between electronic, vibrational, rotational, and translational degrees of freedom. We cannot understand the detailed progress of a reaction until we know which degrees of freedom are activated in the elementary reaction and until we can trace the movement of this energy into the manifold of states at equilibrium. This problem is advancing on many fronts, and a variety of techniques are contributing. Already the results on simple chemical systems are finding applicability and providing suggestive guidance in biological problems. It is clear that the exchange of information and contrast of progress in this symposium (29 December) were timely and valuable.

M. A. El-Sayed (University of California, Los Angeles) outlined the modes by which an excited organic crystal dissipates its electron energy. The data led to a model involving triplet-triplet energy transfer from the host to the impurity, followed by heterogeneous triplet-triplet annihilation. Glenn Crosby (University of New Mexico) turned to the intramolecular energy transfer in metal-organic compounds. Excitation into either the ligand absorption bands (π-π^*) or metal-2 ligand bands (d_{π^*}) gives luminescence in the d-d transitions essentially localized on the central complexed atoms. The bearing of these results upon the adequacy of existing molecules for intramolecular energy migration was discussed.

Herbert Broida (University of California, Santa Barbara) reviewed the experimental results of selectively populating a specific rotational level of a given vibrational and electronic state of a molecule by means of absorption of electromagnetic energy. Subsequent removal by collisions of rotational, vibrational, and electronic energy was studied by measurement of steady-state populations as determined by the emission of photons from the electronically excited molecules. Two specific examples were given involving NO and CN.

Relaxation of vibrational degrees of freedom was considered by W. A. Klemperer (Harvard). The experiments involved selective excitations of I_2 to particular and well-known vibrational and rotational states. The resulting emission permits deduction both about the mass dependence for vibrational deactivation and for the ΔJ selection rules for rotational deactivation in collisional processes which challenge conventional assumptions of current theories. Finally, C. Bradley Moore (University of California) described experiments in which fluorescence from the bending vibration of methane was excited through selective laser excitation of the methane asymmetric stretching motion. His work gives promise of direct information on the rate of intramolecular energy transfer among vibrational degrees of freedom.

Ellen Weaver (Stanford University) reviewed the status of understanding energy transfer in photosynthesis. She related this to her own EPR studies of various strains of algae. John Adams (Chevron Research Company) described a series of experiments involving EPR relaxation measurements of

free radicals in the gas phase and in solution, and he interpreted the results in terms of several models.

Harden McConnell (Stanford University) discussed excitons in paramagnetic organic crystals. These excitons effect not only the EPR spectra but also the scattering of x-rays and the phase transitions in the crystals. G. Wilse Robinson (California Institute of Technology) presented the final paper on the subject of electronic and vibrational excitons in crystals of aromatic molecules. He discussed the splittings observed in optical transitions and how these are related to the electronic exciton interaction. He also discussed the effective mass of excitons and energy transfer rates within the crystal.

GEORGE C. PIMENTEL and
HARMON W. BROWN,
Program Arrangers

Two sessions of contributed papers comprised the last day's (30 December 1965) program of Section C.

The first group of papers was largely concerned with physicochemical separation processes; particular attention was given to chromatographic techniques. A description was made of a method for determining sorption isotherms of vapors on granulated sorbents. Radioactive tracer pulses were used over wide ranges of temperature and pressure. The application of liquid chromatography to systems ranging from unstable diazonium salts to polymers, derived from polybutadiene to lipid extracts from tubercle bacilli, was discussed in some detail. The evaporation of solvents from resin films was studied with attention to the various factors involved. The solvent activity as a function of concentration was determined by an isopiestic method. A spectacular set of color slides illustrated the use of a sample, hot wire capable of producing a controllable temperature gradient on a microscope stage; representations of phase diagrams of many substances could be obtained directly.

The afternoon session dealt with other aspects of physical chemistry as well as spectroscopy and energy transfer. A study was reported of the lifetimes of several vibronic levels in the B state of I_2 by the rotating shutter, phase shift technique. The fluorescence lifetimes varied from level to level while the quenching constants did not. The role of charge transfer states in enhancing the phosphorescence of donor anthracene was discussed, and the effect of varying the acceptor was described. In the photosensitized *cis-trans* isomerization of octene-2 the effectiveness of various sensitizers was correlated with the positions of their triplet levels. Two of the papers described different optical techniques for making physical measurements. That depolarized light intensity is a useful technique was demonstrated in the study of transitions in polymers. The depolarization of light by a sample changes with temperature, and some transitions can be found that are not seen with the well-known differential thermal analysis method. The diffusion coefficient and the activation energy for the diffusion of copper into cadmium sulfide have been determined by monitoring the transmitted light intensity and using a model for the mechanism of light absorption by the copper centers. Studies of the Kerr effect in polypeptide solutions and organic solvents were reported. They could be interpreted in terms of a large degree of association between molecules, which also produce enormous viscosities. Finally, a reaction mechanism study showed that the metal chelate catalysis of the reaction between alcohols and isocyanates can be quantitatively described if it is assumed that alcoholysis of the metal compounds is the first step in the reaction sequence. The resulting alkoxy compound is the actual reactive species.

JOHN W. OTVOS,
Program Arranger

Astronomy (D)

Section D met in joint session with the American Astronomical Society and the Astronomical Society of the Pacific.

Sessions of contributed papers were held on 28–30 December 1965.

On 29 December a special session was held on "Chemical abundances as clues to nuclear astrophysics and galactic evolution." This was introduced by a review paper by George Wallerstein (University of Washington), and followed by nine papers on specialized topics connected with unusual chemical abundances.

On the evening of the 29th, the Helen B. Warner lecture, "Studies of stellar magnetism: past, present, and future," was given by George W. Preston (Lick Observatory).

The morning of 30 December was devoted to a discussion of some controversial topics in planetary astronomy. After a review paper by Hyron Spinrad (University of California, Berkeley), nine papers covered radio and optical observations and theoretical discussion of the planets Mercury, Venus, Mars, and Jupiter.

The Society dinner was held on 29 December.

The meetings were well attended and even though concurrent sessions were held, both lecture halls were generally crowded.

FRANK BRADSHAW WOOD, *Secretary*

Geology and Geography (E)

The most exciting day of the Berkeley meeting of AAAS for geographers was undoubtedly 27 December. A large audience heard an excellent series of papers by former students of Carl Sauer on cultural geography. The subjects discussed ranged from a detailed analysis of the expansion in North America of the Athabaskan-speaking Indians to the distribution of the mithan variety (*Bos frontalis*) of domesticated bovid of Southeast Asia. That man still has a "trick up his sleeve" in developing a cultural scene wholly unique in all history was pointed out by David Lowenthal, who read a paper entitled "The American scene." He described various viewpoints concerning our appetites, desires, decisions, and evaluations which have brought our own problematical and controversial culture into being.

The Section E dinner featured an impromptu exposition on geographic viewpoint by Carl Sauer as he acknowledged the honor paid him by his students during the day's sessions. Trevor Lloyd (McGill University) delivered his retiring vice-presidential address entitled "International scientific collaboration in the Arctic." Lloyd shared with his audience numerous personal experiences and encounters with the Soviet government and personnel which illustrated the difficulties of carrying on completely successful, scholarly effort when political differences, viewpoints, and rivalries constantly intervene. However, Lloyd also emphasized how much has been learned of the geography of the northern high latitudes in the very few decades since technological improvement of transport, communication, and food and clothing has opened

the Arctic to the present-day type of investigator. Many of his listeners must have thought of how far and swiftly we've come from the days of Peary and Amundsen and, indeed, since the day of Byrd and Stefansson.

The session on Remote Sensing of Environment (28 December) reviewed the many new developments in an area of science and engineering which is destined to place tools in the hands of investigators almost beyond their fondest dreams. The audience was made aware of the possibility that "you ain't seen nothin' yet" as the speakers hinted at marvels of remote sensing which may soon be removed from security wraps. (Persons interested in remote sensing should be aware of a forthcoming symposium on the subject to be held at the Univeristy of Michigan in April, 1966.)

Papers on Tertiary Provincial and Immigrant Faunas attracted the "bone paleontologists." It was clear that the work of Cope and Marsh and Loy Miller (University of California, Berkeley) has been handed down to young men with great patience in pursuing the search for remarkably scarce bits of evidence, and the skill to interpret what they do discover after endless hours of arroyo walking.

Another group of geologists was attracted to a limestone hydrology symposium organized by the National Speleological Society. The spelunkers reported on interesting processes of erosion, related to bedding plane circulation. They also described patterns of ground water circulation in carbonate rocks of complex structure which are revealed by chemical quality and other parameters, such as quantity and temperature.

Section E sessions concluded with an unusual symposium on extraterrestrial sedimentation (29 December). The geologists, together with astronomers and meteorologists, heard about the probing of other planets and the necessity of theoretical studies for an understanding of processes on other planets with atmospheric and other physical conditions which contrast to those of the earth. It's a curious turn of events if, in our zeal to explore extraterrestrially, we develop instruments and techniques and make observations which ultimately will enable us to discover more of the vast unknown concerning our own planet.

Harry Ladd (retiring vice-president of Section E) announced the election of Joe Webb Peoples as vice-president of Section E for 1966. He invites suggestions for, inquiry about, and attention to announcements concerning the section program to be arranged for the annual meeting of AAAS to be held in Washington, D.C., 26–31 December 1966.

RICHARD H. MAHARD,
Secretary

Tertiary Provincial and Immigrant Terrestrial Vertebrates

This symposium, held on 29 December 1965, was part of the program of Section E.

The science of historical zoogeography is now at that stage in which detailed data are needed to more clearly define when, where, and under what ecologic conditions land mammals were or were not able to disperse between faunal provinces or between continents. The Pacific Coast Province has remained more or less an isolated faunal unit since the earlier part of mammalian history. According to Malcolm C. McKenna, the older faunas of this province show apparent strong endemism in the middle Paleocene but there is increasing pandemism in the later Paleocene to Oligocene. This prominent pandemism appears to continue into the middle Miocene, according to Faunal evidence from the Mojave Desert area presented by Richard H. Tedford. However, with the late Miocene there is a change to increasing endemism in the Pacific Coast Province, possibly because of progressive climatic zonality.

Climatic zonality appears to have been responsible, by the late Miocene, for divergent evolution in several mammalian lineages. Thus at this time, according to S. David Webb, the forests of the northern Pacific Coast Province were frequented by browsing camels, ancestral to the living Old World camel. However, the grasslands of the southern Pacific Coast Province were frequented by grazing camels that were ancestral to the living South American llama. Other ecologic conditions separated the eastern and western moles since at least the late Miocene, according to J. Howard Hutchison. The Pacific mole ranged from the southern grasslands to the northern forests within the Pacific Coast Province.

South American immigrants became quite prominent in the southern Pacific Coast Province during the late Pliocene and Pleistocene. This is shown by a number of new forms in the succession of faunas from southern California described by Theodore Downs and John A. White. Other remarkable South American immigrants are the fossil capybara from eastern Arizona described by John F. Lance.

CHARLES A. REPENNING,
Program Arranger

Zoological Sciences (F)

Section F cosponsored a five-session symposium on Molecular Mechanisms of Temperature Adaptation. Plant, animal, and microbial physiologists and biochemists combined efforts and were surprised to find that each group, working with very different organisms, was arriving at similar conclusions concerning genetic variations in respect to temperature and mechanisms of acclimatization. Several zoological societies had programs of contributed papers and symposia. The American Fisheries Society had a symposium dealing with the Sacramento-San Joaquin Estuary. The Herpetologists League sponsored three sessions of contributed papers. The Society of Systematic Zoology sponsored a very popular two-session symposium on systematic studies of fauna on the Galapagos, a symposium on Biological Data Retrieval and Computer Analysis, and four sessions of short papers. The American Society of Zoologists featured the following symposia in addition to the one on temperature adaptation: Hypothalamic Control of the Anterior Pituitary (2 parts), Neurosecretion of Invertebrates other than Insects (4 sessions), The Vertebrate Ear (2 parts), Problems in Invertebrate Embryology (3 parts), and Modern Approaches to the Study of Adenohypophyseal Structure and Function (2 parts). There were five sessions on Developmental Biology, four on Invertebrate and General Zoology, six sessions in Comparative Physiology, four in Comparative Endocrinology, three in Vertebrate Morphology, and sessions on Radiation Biology, Ecology, Cytology, and Genetics. The Animal Behavior Society had a symposium on Experimental Analysis of Aggression, also separate sessions on learning, agonistic behavior, territorial and parental behavior, sexual behavior, communication, orientation, and navigation.

New officers for Section F include Richard B. Roberts (chairman, 1966), David E. Davis (secretary, 1966–69), and George W. Wharton (committeeman-at-large, 1966–69).

C. LADD PROSSER,
Program Chairman

American Fisheries Society (F1)

The California-Nevada Chapter of the American Fisheries Society sponsored a program on recent ecological studies in the Sacramento-San Joaquin Estuary, California.

R. B. Krone described studies on sedimentation in the estuary. Most sediment entering the lower estuary is composed of fine particles, and most enters in a few short periods of high flow during the winter and spring. Resuspension of sediments caused by water currents created by strong prevailing summer winds is a very important factor controlling the distribution of sediment. One factor of great potential biological importance is that sediments may be very important in removing pollutants; suspended solids entering the estuary have 1.5×10^9 millequivalents of adsorptive capacity.

Jerry L. Turner pointed out that seasonal variations in the abundance of zooplankton in the delta are controlled primarily by water temperature. However, water quality and residence time of water are the primary factors controlling local variations in abundance. In fresh waters of the delta, zooplankton was most abundant where total dissolved solids were highest and where residence time of water was greatest.

Harold K. Chadwick described migrations of the adult striped bass in the estuary. Migration patterns have changed significantly in the past 15 years; adult bass generally migrate farther downstream in the summer and remain downstream longer. The extent of downstream migration is positively correlated with fish size; thus changes in size composition in the population may have contributed to the changed patterns. Improved water quality in downstream areas may also have played a role, but insufficient knowledge of the environment and the bass population prevented a thorough analysis of the causes for changed migrations.

David Ganssle described movements of fish and shrimp in the salinity gradient. Except for anadromous species, movements were greatly influenced by the position of the salinity gradient. The gradient's location varied annually as well as seasonally, thus causing significant annual differences in species distribution.

HAROLD K. CHADWICK,
Program Arranger

Animal Behavior Society (F3)

The program consisted of seven half-day sessions of contributed papers, one full-day symposium on the experimental analysis of aggression, and a half-day session of invited papers devoted to the teaching of animal behavior. In addition to the traditional areas of social behavior, including agonistic, territorial, maternal, and sexual behaviors, papers concerned with comparative learning phenomena and with a variety of invertebrate behavior patterns highlighted the meetings. Noteworthy was the general level of sophistication of the reports, particularly with respect to the trend toward the use of quantitative methods in the collection of behavioral data. Papers presented at the session on orientation, homing, and navigation were particularly stimulating. The interaction of environment and social behavior was stressed in studies of aggressive and territorial behavior. Studies concerned with sexual behavior continue to reveal the intricate interaction of gonadal hormones, neural and experiential mechanisms.

EDWIN M. BANKS,
Program Officer

Herpetologists' League (F4)

Papers, dealing principally with problems in ecology and systematics, were delivered during the annual meeting (29–30 December 1965) of the Herpetologists' League.

A lively discussion was precipitated by William Duellman's talk on Mexican herpetology. Duellman sharply criticized a recent spate of unscholarly publications based on Mexican material. He also deplored the fact that indiscriminate collecting in Mexico by nonprofessionals is creating a large number of small, scattered collections which contribute nothing to the advancement of science.

Papers by Frederick Turner were related to various aspects of ecological research on lizards. Such research is supported by the Division of Biology and Medicine of the U.S. Atomic Energy Commission. Some of his investigations pertain to the Rock Valley facility at the Nevada Test Site, where long-term studies of natural desert communities are in progress.

The prize of $25 for the best student paper was awarded to Angel Alcala for his discussion of the ecology of the skink, *Mabuya multifasciata*, in the Philippines. Honorable mention was awarded to Dan Willard for his paper on *Cnemidophorus tigris*.

Officers elected for the 1966–67 biennium were as follows: President, Philip W. Smith; vice-president, John M. Legler. Newly elected members of the Executive Council are: James Anderson, Clarence McCoy, Richard Etheridge, and William Milstead.

Zoological and Botanical Sciences (FG)

Ecological Society of America (FG3)

The Ecological Society of America met, with the AAAS, at The University of California in Berkeley. During the four days of the meeting, the society sponsored or cosponsored approximately 30 sessions at which attendance ranged from less than 25 to more than 400 scientists. Sessions on animal behavior were most numerous; there was one session of invited papers, seven of contributed papers, and two symposia. The symposia dealt with the experimental analysis of aggression in fighting mice (F. H. Bronson), in Siamese fighting fish (T. Thompson), in grey-hooded rats (T. J. Stachnik), in monkeys (J. M. R. Delgado), and in rodents (J. P. Scott).

Read at two sessions each were contributed papers on animal ecology, aquatic and marine ecology, and diversity and abundance in natural communities. There was one session each on population and community bioenergetics, human ecology, physiological ecology, and vegetation.

Those who attended the very popular symposium on primary productivity and mineral cycling in natural ecosystems heard a fascinating explanation of the famous lemming migrations as they relate to vegetation changes and mineral cycling, especially that of phosphorus

(A. Schultz). Stable air masses incident to nocturnal temperature inversions were described (G. M. Woodwell and W. R. Dykeman) as convenient systems in which rates of accumulation of CO_2 can be measured at different heights above the ground. From such measurements a tentative estimate of 2810 grams of $CO_2/m^2/year$ has been made for total respiration of an oak-pine forest on Long Island. This they estimated was equivalent to about 1700 grams of dry matter.

The field trip, arranged and conducted by Peter Raven, proved to be an invigorating and enlightening experience for about 25 biologists. Howard Cogswell, during a stop at the intertidal salt flats on San Francisco Bay, described ecological work in progress there. The redwood forest in Big Basin State Park and the Ben Lomond Sand Hills were also visited.

The ecological implications of the Rampart Canyon Dam were discussed by a panel comprised of A. Starker Leopold, Gordon Watson, and William S. Benninghoff. The session, presided over by Stephen H. Spurr and attended by approximately 175 persons, brought to light information which seems to cast serious doubt on the wisdom of relinquishing irreplaceable natural resources and the historic rights of an aboriginal people in exchange for what has been described as "the hardware of civilization." The plan to dam the Yukon River in Rampart Canyon would produce a 286-mile lake with 1100 miles of wave-washed shoreline. Nearly 2000 Athabascan Indians, whose ancestral home has been the Yukon Valley in this area, would be permanently displaced. In addition, a substantial part of the salmon fishery would be destroyed, and large herds of moose and other game would be eliminated. Marshes, flood-plains, and primary successional vegetation incident to natural erosion and silting patterns would be eliminated, thus removing the breeding grounds for an estimated 1.6 percent of the total continental duck population, and destroying feeding areas now used by 1.5 million migratory ducks per year. Paradoxically, proponents of this dam, in flooding more than 3.7 million acres, would eliminate more duck feeding and breeding area than could ultimately be purchased with the proceeds of the Federal duck-stamp tax, established to provide for such purchases over a 30-year period. Many persons left this panel discussion wondering whether the proposed Rampart Canyon Dam may not be, in the spirit of the book title of a decade ago, "big dam foolishness."

The Ecological Society, with AAAS, the Society of American Foresters, and the American Meteorological Society, was cosponsor of seven-part symposium entitled "Ground level climatology." Discussion of specific problems related to the climate near the ground was heard in six of the sessions, while part III, a general session symposium presided over by Robert H. Shaw, pursued the "Implications of weather modification on ground level climatology." R. H. Whittaker suggested that small changes in climate, such as those now possible through cloud seeding, might be so sudden as to disrupt life cycles of established plants and encourage the spread of more aggressive weeds. He pointed out that some species which are already surrounded and confined by manmade barriers, unable either to migrate or adapt, might succumb to relatively minor environmental changes. Cautioning that extinction of species from a community reduces species-diversity which is, in turn, directly related to the stability of the community, Whittaker recommended: (i) acceleration of research into ecological aspects of weather modification; (ii) constrainment of the area and extent of weather modification so as not to alter our important preserves of natural communities; and (iii) that a strategy of minimum application of weather modification be applied in all instances.

Abstracts of the papers were published in the *Bulletin of the Ecological Society of America*, vol. 46, No. 4, December 1965.

BENJAMIN F. GRAHAM, JR.,
Visiting Biologist,
Brookhaven National Laboratory

Botanical Sciences (G)

The 5th annual symposium, "Plant biology today: advances and challenges," took place in Berkeley on 30 December; it was arranged jointly with the Pacific Section of the Botanical Society of America. The subjects ranged from broad plant geography and ecology down to the level of electron microscopy.

The distribution of plant populations in relation to soils was analyzed in modern terms by A. R. Kruckeberg, who showed how the subject has changed through the years, and how discontinuities in the edaphic factors exercise profound influences on the occurrence of plant species. By selecting as examples some of the most extreme types of rock substrata (for example, limestones, serpentines), he was able to bring out a number of problems which face the soil ecologist. He also emphasized the need for recognizing the complexity of interactions of competition and physiology. The study of pollens was related by Estella B. Leopold to the other botanical sciences, showing how these tiny but very distinctive plant cells bear upon the history of past biota in terms of evolution and the changing floras. She illustrated the different types of pollens and the uses (and misuses) of pollen diagrams. Botanists of other disciplines, including taxonomy and ecology, were urged to take advantage of the kinds of information that palynology can provide. The present-day speculations on the origin and relationships of the liverworts provided the basis of a critical analysis by Johannes Proskauer, leading to the conclusion that the bryophytes and pteridophytes probably had a common ancestor which was already a land plant. Furthermore, this ancestor was most probably a pteridophyte. Proskauer exploded a number of traditional morphological dogmas in examining the evidence.

Paul Mahlberg surveyed the latex-producing organs of higher plants in terms of the different types which have been discovered as well as their ontogenetic development and cytology. He discussed the problems of the nature and function of latex itself. He then showed the results of experiments in which laticifer-free shoots were produced, suggesting a number of intriguing developmental questions. Norma J. Lang presented a thought-provoking review of our present knowledge of structure and differentiation of the blue-green algae, comparing them with the bacteria, and emphasizing the recent discoveries under the electron microscope. In a logical, step-by-step analysis, she examined the hypothesis that the origin of the chloroplasts of higher plants may have been a consequence of an original symbiosis of blue-green algae with non-photosynthetic cells. G. Ledyard Stebbins reanalyzed our traditional ideas of chromosome varia-

tion and evolution in terms of the new cytological and genetic findings over the past decade. Evolutionary trends involving chromosome size, reduction in chromosome numbers, and polyploidy were reexamined in terms of their adaptive significance.

Topics in a session of contributed papers included: dispersal mechanisms in island plants (Sherwin Carlquist), chemical plant taxonomy (W. A. Emboden), electron microscopy (of crystal formation in cells, by H. J. Arnott, and of cambium, by L. Srivasta), and various problems in plant biochemistry and microbiology.

At the Botanists' Luncheon, the vice-presidential address was presented by Ira L. Wiggins. His illustrated lecture dealt with the results of his recent field research in one of the best known island groups in the world; it was entitled "The Galapagos Islands in retrospect—and prospect."

The joint meeting of Section G and the Pacific Section of the Botanical Society of America (G2) proved to be very stimulating. A room as headquarters for all botanists was kept open for the entire period of the meetings. The new officers elected in Section G for 1966 are Charles E. Olmsted, vice president and chairman; and Pierre Dansereau, committeeman-at-large.

WARREN H. WAGNER, JR.,
Secretary
JANET R. STEIN,
Secretary, Pacific Section, Botanical Society of America

Anthropology (H)

Drinking Patterns in Latin America

This symposium, held on 30 December 1965, was part of the program of Section H and was cosponsored by the American Anthropological Association. Paul H. Ezell (San Diego State College), William P. Mangin (Syracuse), Roger C. Owen (University of California, Santa Barbara), and José Pastore (Wisconsin) emphasized that moderate consumption of alcoholic beverages characterizes the middle class in Mexico City, La Paz, Lima, and 26 Brazilian cities. Analyzing over 10,000 questionnaires, Owen found that religious affiliation influences the amount of alcoholic beverage consumption in urban Brazil, and Pastore found that upper-class Brazilians drink more than lower status fellow-countrymen with clear sex differences at all levels.

From remarks made by Bolivians about North Americans, Ezell noted in-group indulgence toward drinkers displaying behaviors criticized in out-group members. Mario C. Vazquez (Cornell), William Madsen (Purdue), and Henry F. Dobyns (Cornell) reported Mestizo deprecation of Indian drinking, and Madsen cited in South Texas Anglo-American indictments of Mexican-American drinking. Dwight B. Heath (Brown) reported how the 1952 revolution turned certain Bolivian landlords, who avoided drinking with their Indian serfs, into shopkeepers who imbibe often with the same Indians, now peasants. Other landlords who frequently drank with their serfs now seldom see them, because they received their own lands during post-revolutionary agrarian reforms.

Increased drinking of native brews among conservative Mexican Indians resisting cultural change was reported by Madsen. This contrasted with the replacement of many forms of alcoholic and nonalcoholic chicha in the Andes by beer and distilled liquors. Vazquez and Allan R. Holmberg (Cornell) calculated the consumption by the average adult at 2 liters of chicha daily.

Paul L. Doughty (Indiana) reported that alcoholic beverages help cement social bonds that permit frequent and effective community-labor projects to be carried out in a Mestizo town in the Peruvian Andes.

Commentators included: Cara E. Richards (Ithaca College), David G. Mandelbaum (University of California, Berkeley), and Eileen A. Maynard (Cornell).

HENRY F. DOBYNS,
Program Arranger

Psychology (I)

In the symposium on modification of deviant behavior in children (Leonard Krasner, Albert Bandura, Charles B. Ferster, James R. Lent, O. Ivar Lovaas, Arthur W. Staats), the central theme was that control efforts are less likely to be successful if based on concepts of internal dynamics, symbolism, the unconscious, or disease entities than if the problems are analyzed in behavioral terms and modification procedures oriented around principles and techniques of the learning laboratory. Thus, the trainer or "therapist" must ascertain by close observation what environmental elements are maintaining the undesirable responses and what readily manipulable elements have rewarding or reinforcing properties (for example, preferred food, toys, exchangeable tokens, escape from pain, social contact). These elements are then arranged to effect step-by-step alterations in the desired direction, with the powerful social reinforcers ultimately provided by parents, teachers, and others. Even observing successful behavior by others, in real life or on film, may have "vicarious" reinforcing value. The principles discussed are applicable as well to work with disturbed adults, and presumably have relevance for the prevention of behavior deviations.

Another discussion was centered around the question, "How does a child learn to talk?" Dan I. Slobin posed as a critical problem the unusual speed of the acquisition process. Simple imitation does not account for this rapid rate; rather, the child passes through a series of stages in which he seems to be inventing and productively using his own childish grammar. David Palermo proposed that the rate is simply the result of very high motivation, and argued that well-established principles of learning can readily account for language phenomena. David McNeill, on the other hand, doubted that such complex behavior can be handled adequately within current theoretical frameworks, based as they too frequently are upon very simple experiments. Cross-cultural similarities of language learning, combined with neurophysiological observations, suggest the existence of an inborn device permitting the child to try out hypotheses about the structure of the language he hears.

Complementing the symposium on Behavior, Brain, and Biochemistry (interdisciplinary symposium), was the symposium on Behavioral Genetics (Gerald McClearn, chairman). V. Elving Anderson described about 30 types of biochemical anomaly, resulting in intellectual deficit, that are chromosomal in etiology. It is estimated that well over 100 gene loci are involved in the abnormal manifestations. Conflicting results in experiments on the facilitation of learning and memory by drug injection (for example, strychnine sulfate, picro-

toxin) were clarified by James McGaugh. Not only is the direction of effect a function of dose level and task, but the shape of the functions varies with the strain of mouse, with instances even of reversals of trend across strains. Interaction with strain is also apparent when the effect of prenatal stress on open-field locomotion in adulthood is examined carefully (John DeFries).

The symposium on Verbal Learning was arranged by Benton J. Underwood and chaired by Leo J. Postman. Rudolph Schulz described experiments demonstrating that associations established in the laboratory produce substantial amounts of mediated facilitation when the training procedures insure availability and discriminability of the relevant terms. Evidence was offered by Kent Dallett to indicate that mediational processes cannot be enhanced effectively by instructions, perhaps because such processes occur spontaneously in most learning situations. The course of learning can fruitfully be considered as comprised of successive stages during which responses and associative connections are acquired, according to Geoffrey Keppel, who described techniques for testing this hypothesis. Leonard Horowitz presented data suggesting the equivalent, in situations involving verbal material, of latent learning. Neal Johnson proposed that grammatical structure serves to define functional response units which may affect rate of sentence learning by reducing both intrasequence and intersequence interference. The possibility of determining the effects of such structure independently of semantic influences was discussed by William Epstein.

Underwood's vice-presidential address considered the role of implicit associative responses (IAR), that is, associations elicited by the to-be-remembered units, in acquisition. A series of studies was reported in which the systematic effects of IAR were demonstrated in recognition, free learning, and paired-associate learning. It was shown that the facilitation attributable to such associations occurs in large measure during acquisition rather than during the test of recall.

The cooperation in the planning of the Section I program by the Western Psychological Association (Gerald Mendelsohn, convention manager) was invaluable.

The Section's chairman for 1966 is Robert M. Gagné (University of California, Berkeley). Newly elected member-at-large of the Section Committee is Leo J. Postman, also of Berkeley.

FRANK W. FINGER, *Secretary*

Social and Economic Sciences (K)

The Symposium on the Mathematical Bases of Economic Planning, chaired by George Dantzig (University of California, Berkeley) was intended to highlight the ways in which advanced mathematical methods have contributed to our understanding of the planning process in such diverse economies as those of India, the Soviet Union, and the United States. Academician L. V. Kantorovich was unable to accept an invitation to participate.

Kenneth Arrow (Stanford University), whose paper was jointly authored with Mordecai Kurz (Hebrew University, Jerusalem) and Sukhamoy Chakravarty (Delhi School of Economics, Delhi, India), dealt with the problem of time perspectives in planning. The decision as to how much a society should invest now, that is, a decision as to the optimum rate of growth, involves planning over a finite time period for an infinite future. The classical method for taking account of decreasing concern for remote futures is the interest rate. More sophisticated optimizing models, however, need to assume some more complex utility function both within and between time points in the future. Such problems have been dealt with in the past by variational calculus using Euler and LaGrange equations. Recently, important contributions to the mathematics of optimization have been made by L. S. Pontryagin.

Jacob Marshak in his paper on the organizational economics of planning also dealt with planning as a multistage decision on strategy—a time sequence of functions. Sequential receipt of information creates certain decision problems closely paralleling those analyzed by David Blackwell and M. A. Girshick.

Other programs of Section K that dealt with mathematical models included the American Economic Association's meeting on Economic Analysis of Policy Making and the American Political Science Association's session on Systematic Studies of the Characteristics of and Interaction in the World Communist System. In a paper in the latter session, Richard A. Brody and John Vesecky (Stanford University) evaluated the application of Lewis F. Richardson's mathematics of the arms race to current Soviet-American relations. They found that fitting the Richardson equations to data from the years 1953–61 suggested that a runaway arms race was in progress whereas for the years 1962–64 there were lower annual changes, approaching a relatively stable equilibrium.

The meeting arranged by the American Sociological Association, like that of the American Economic Association, focused on the role of social science in the policy-formation process with the sociologists looking at the problem in developing countries.

ITHIEL DE SOLA POOL, *Secretary*

American Economic Association (K1)

Section K1's program was concerned with the role of economic analysis in policy making in the United States. While much has been written regarding how formal economic analysis should be used in economic policy making, very little has been written regarding how, in fact, economic analysis has played a role.

Edward Kalachek (Washington University of St. Louis) examined the role of economic analysis in diagnosing the causes of the high unemployment rate that persisted during the 1957 to 1961 period. Two very different explanations existed. One stressed severe mismatch of available jobs with worker capabilities. The other stressed shortfall of overall demand. Kalachek pointed out that proper evaluation of the relative importance of these two causes had to precede prescription of a treatment. If the former diagnosis was largely correct, strongly expansionary fiscal and monitary policy would have serious side effects, and a heavy dose of complimentary labor-market policy was needed. If the latter explanation was correct, strong expansionary fiscal and monetary policy was the proper treatment, and there was little to fear in the way of inflationary side reaction. Kalachek explained how economic theory suggested various ways to discriminate between the alternative hypotheses and the statistical tests which were actually undertaken and their results. As a result

of these studies it was judged that the major problem was insufficient aggregative demand; there was very little evidence of any unusual problems of structural mismatch.

John Blackburn (Duke University) then examined the issues the federal government had to face in selecting a policy for stimulating increased overall demand. He pointed out that the government had other objectives in addition to that of reducing unemployment and was operating under a number of constraints. In particular, the government wanted to increase the rate of growth of productive capacity and was under strong pressure to reduce the balance of payments deficit. There were many alternative instruments which could be used—a variety of possible tax reductions, various increased spending programs, and various measures which could be used to influence the supply of credit. He described how economic analysis was used to illuminate the alternative policy packages, which could be used to deal with the unemployment problem and the consequences of alternative packages in terms of these other objectives. He attempted to reconstruct the considerations which led to the heavy employment on tax reductions in the policy package which ultimately was proposed and implemented.

Richard Attiyeh (Yale University) focused on a particular objective which strongly colored the decision—the objective of stimulating rapid market growth. He examined the role of investment in influencing the growth rate and suggested how the question of an optimal growth policy should be posed.

RICHARD R. NELSON,
Program Chairman

American Political Science Association (K2)

Systematic Studies of the Characteristics of, and Interaction in, the World Communist System

The chairman of this panel, Jan F. Triska (Stanford University), introduced the theme of the discussion and the panel members. He said that in the past, while there has been a great deal of theorizing on the subject of communism and communist affairs, there have been very few precise and verifiable theories; the principal modes of analysis, even in political science writings, were historical, descriptive, and situation-bound, based principally on a sort of content analysis and sustained confrontation of primary and secondary sources. Lately, however, the situation has been changing. Increasingly, there have been attempts to put emphasis on systematic empirical inquiries by modern techniques of systematic research, and on empirical studies of political behavior with a view towards empirical theory building. This panel, Triska said, is a good example of this change.

David D. Finley (Colorado College) reported on research now in progress by the Stanford Studies of the Communist System on "Integration and community-building among the 14 communist party states," a series of empirical studies of the individual state. Members of the world communist system are based on a common paradigm. When completed, these 14 studies, Finley said, should offer evidence on the propensities in the communist system toward unification of the national units.

Richard A. Brody (Stanford) presented a paper on "Soviet responsiveness: a critical evaluation of certain

Pressroom

One of the busiest pressrooms at any U.S. scientific meeting is regularly that at the AAAS meeting. The Berkeley meeting was no exception, with some 150 reporters and 50 others checking in at the pressroom.

Most press coverage went to three symposia—"Behavior, brain, and biochemistry," "Civil defense," and "Physiological control of conception and its implications." The slant the press gave these stories, and four other events most popular with reporters, will be summarized in the March issue of the AAAS *Bulletin*.

Coverage by radio and television rose sharply at this meeting. In earlier years from eight to ten networks and stations were represented in the pressroom; this year the number was 15.

Some 30 press conferences were conducted during 5 days. These meetings between scientists and the press are central to the pressroom operation, for here reporters can ask questions and get answers.

To complement the press conferences, reporters want copies of each speaker's paper and an abstract of it. Of the 1500 papers read, the authors of more than 550 were kind enough to send at least an abstract.

New this year. To speed transmission of reporters' copy back to their home offices, this year Western Union installed four Telex transmitters in the AAAS pressroom. At times all four machines were in use—some 125,000 words of copy were sent in the 5 days. (In earlier years, messengers carried the copy to the local Western Union office.)

Another innovation for AAAS at Berkeley was a "listening room" in which reporters could hear a few of the key sessions underway at Harmon Gymnasium some distance from the Berkeley campus pressroom.

A third new feature involved the press conference for the astronauts of Gemini 6 and Gemini 7. Though it took place in Houston, science writers in Berkeley were able to participate—thanks to a two-way speaker-telephone hookup.

Special thanks are due Ray Colvig and coworkers in the public information office at the University of California, Berkeley. Ray, Don Koue, Jack Allard, and others did a great deal of the work.

As always, a highlight of the meeting for the press was the AAAS-Westinghouse science writing awards banquet. More than 200 persons saw awards of $100 each presented to William Hines, Washington *Star*, and Lawrence Lessing, *Fortune*. The awards are the only major national prizes for writing in science (excluding medicine). Hines won the newspaper award for a series of some two dozen articles on the epic journey of Mariner IV to Mars. Lessing won the magazine award for a piece on earthquake-prediction research. Honorable mention went to Raymond Bruner, Toledo *Blade*; Max Gunther, freelance writer; and Warren R. Young, *Life*.—KNEELAND A. GODFREY, JR., AAAS

hypotheses about Soviet foreign policy behavior" [See Harry Schwartz, "Social scientist relying on math," The New York *Times*, 29 December 1965, p. 16, cols. 1 and 2]. Brody and his coauthor, John Vesecky, examined C. F. Richardson's model of "arms and insecurity" (changes in a state's behavior in international relations are responses to either behavioral changes of other nations or fatigue at home), and applied it to the Soviet-American relations and the Cold War. Their conclusion was that "concerns over power, security and interest are necessary ingredients in the analysis of foreign policy; their sufficiency is subject to doubt."

Robert C. North (Stanford) prepared a theoretical paper entitled "An approach to problems of national and international integration." He suggested that the stimulus-response model S-r: s-R which he and others developed and used to test empirically a range of hypotheses about international conflict may be useful in studying integration among individuals, groups, states, and combinations of states. North said that replicatable empirical testing of this model for study of integration in the communist system is now feasible.

Ole R. Holsti (Stanford) had his data analyzed by IBM 7090 sets of Soviet and Chinese documents, and concluded that in spite of their conflict, the two communist-party states appear to display similar attitudes toward the war in Vietnam. As a consequence, Holsti stated in his paper "External conflict and internal consensus: the Sino-Soviet case," the U.S. attempt "to solve" the Vietnam crises by the presently used means may drive the U.S.S.R. and China closer together.

The three commentators—M. George Zaninovich (University of California), Thomas W. Milburn (Northwestern), and William R. Van Cleave (Stanford Research Institute) critically evaluated the four papers. Together with the speakers, they participated in the question and answer period which followed the panel discussion.

JAN F. TRISKA,
Program Chairman

National Institute of Social and Behavioral Science (K6)

Six contributed papers, all bearing on foreign affairs, constituted the program of the National Institute of Social and Behavioral Science. Social change in the U.S.S.R., not to exclude the area of mainland China, comprises perhaps the core of the problem for orderly international processes in the contemporary period. The underdeveloped posture of the Russian nation in the social sciences is striking, particularly in view of its advanced status in fields of natural science. A penetrating treatment of these subjects was presented by Peter R. Senn (Northwestern University) in a study concerning concepts of social science and social change in the U.S.S.R. The failings of Russian social science conceptually has been due to its dependence on the society which produced it. The anachronism largely remains even though Russian society has evolved pragmatically, incurring an alternative social cost. The aproach of Lenin and later Marxists essentially eschewed problems of social science and advanced little beyond Marx and Engels. Through the Stalin period, with few exceptions, Russian social science remained outside the mainstream of development. Currently the field has no set body of knowledgeable orthodox theory, with institutionalism prevailing in the midst of empiricism. The impact of the lack of a developed social science reflects upon Russian education and upon the perspectives and the quality of decision-making of Russian leadership both within the country and in its international relations. However, Soviet social scientists lean toward world social science, primarily still in econometrics and in some areas of sociology and related fields. As the quality of their efforts progresses, an eventual interest in modern theory and its use may be anticipated in order to advance their own research. Yet unexplored in any depth, however, are theoretical developments in social science and what theory is implicit in certain practices, what areas relate to social change, and what new knowledge awaits from the study and application of economic and political theory.

David C. Schwartz (University of Pennsylvania) discussed the influence of strategic factors on decision-making in international crises. His findings suggest the general validity, and some of the limitations, of deterrence theory. American aerospace operations in crisis seem to produce changes in Soviet preceptions of U.S. capability and resolve and hence increase felt-threat to Soviet decision-makers. Such increases in felt-threat generally are associated, among others, with modifications in perceptions of relative costs and gains of various policies, receptivity to communications from opponents, and perceptions of the "tide of history." Crisis management is conceived of as an influence process. Criteria were developed for evaluation of the political utility or influence capability of specific military factors, drawing upon analytic models of crisis and sociopsychological theories of influence. Actual and projected force-structures, weapons systems, and operations were evaluated in terms of these criteria. A partial model of crisis decision-making was elaborated which draws upon and synthesizes major theoretical approaches to international relations.

The political process in France and its role in current French foreign policy was the topic developed by Elijah Ben-Zion Kaminsky (Arizona State University). Alternatives to Gaullist foreign policy, as indicated in the expressions of opposition candidates in the recent election, was a major concern of this research. It was implied that Antoine Pinay, a "moderate conservative," presumably could have done much to reorientate French foreign policy away from Gaullist trends. Perhaps he could have effected a revision of the Peking recognition policy, had he but run for office successfully. The election campaigns all indicated degrees of criticism of Gaullist diplomacy, and this fact, together with some adjustment of American policy in Europe, may influence important favorable shifts in future French external policy. The opposition candidates also questioned continuation of an independent French *force de frappe*; supported a united Europe apparently without resolving the role of nationalism; and, as expected, remained divided on problems of socialism and free markets. However, in general, the candidates concurred on agricultural policy and the procedures of the Treaty of Rome. It might be determined upon examination that a normative approach in foreign affairs was best stated among the French politicians by Marcilhacy and Tixier-Vignancour. Whether or not they, with Pinay, can influence the incumbent regime toward solidarity in the Atlantic Alliance and ameliorate the myth of American "hegemony" in problems of common defense remains to be observed. The author anticipated a genuine will in France toward a strong Europe. This sentiment intrinsically

would be an asset to the United States, especially under increasing degrees of cooperation with American foreign policy.

Douglas H. Mendel, Jr. (University of Wisconsin at Milwaukee) analyzed questions concerning the future of the Japanese-American alliance. The security treaty renewal in 1970 will involve directly or indirectly consideration of such matters as American military base privileges in Japan and Okinawa, the status of the Bonin Islands, expanded rearmament for Japan, the relations of Japan with other Asian countries and the U.S.S.R., and the projected security posture of Japan. Trends in Vietnam also may have an impact on the course of treaty negotiations. Japanese public opinion should be calculated in assessing many of these problems. This approach, of course, would assume qualities of discernment in the makeup of public opinion. In foreign policy especially, public opinion possibly might become the public's own worst enemy. In countries of high literacy, responsible public opinion tends to depend upon a responsible press. This is all to say, the specialist on international security policy and the social scientist should hold counsel and not without consideration of public opinion. The study itself does not foresee a broadening of the alliance involving Japanese military expansion. But perhaps the important point to weigh in future treaty relations is the total aid and welfare Japan obtains, and would not otherwise enjoy, from close strategic contacts within the alliance (including its support of Free China) with no loss of national dignity and with continuing prospects for economic expansion, political stability, and international prestige.

Inflation as a problem of contemporary economic growth in Japan was surveyed by Robert S. Ozaki (California State College at Hayward). In recent years inflation in the consumer price level in Japan has occurred at an annual rate of about 6.5 percent. Even though the gross national product has also increased at a rate of about 12 percent, there remain policy problems resulting from rapid inflation concerning equity, the propensity to save, and the inevitable breakdown of the resource-allocation function of the price mechanism. Any or all of these conditions affect economic growth. The recommendations were that no deflationary measure be adopted to decelerate growth and that sustained productivity advances in all economic sectors be encouraged. The latter would involve agriculture, small business, and service industries. Other proposals concern optimal allocation of labor, more liberal importation of foreign foods, given free operation of the price mechanism, and a more effective anti-monopoly policy which would discourage excessive union wage demands. It is a matter of concern that autonomous wage increases beyond productivity growth in the consumer goods sector may have sufficient impact on wholesale prices as either to force external currency depreciation or suffer vitally from international trade and exchange disequilibrium.

Cabinet instability during and since the Communist administration in Kerala and its implications for politics and government in India was reviewed by John W. Spellman (University of Washington). The 1957 Communist administration of Kerala state, soon after its installation, alienated interest groups and communal organizations under its jurisdiction, including the Nairs, Ezhavas, Christians, and Muslims.

The Christians, for example, were concerned about Communist bills designed to control the educational system. After two years of agitation and turmoil the Communist ministry was constitutionally dismissed and President's rule declared. Even though the Congress Party has been dominant, cabinet instability persists, largely because of intra-party factionalism and defection within the Congress Party itself. This defection has to some extent benefited the Communists. To lessen factionalism and to promote political stability, it was suggested that the Congress Party might adopt a more specific identity and establish well-defined hierarchical positions based on seniority. But a strong second party of moderate, non-leftist orientation, if such could evolve, should in itself influence political maturity. Although other Indian states are more stable than Kerala, questions of party relationships were given as nonetheless relevant for the whole of India and its political future.

This meeting represented the most successful session for contributed papers the National Institute has held. This achievement was materially assisted by the able services of W. Glenn Campbell (director, Hoover Institution on War, Revolution, and Peace). Selected materials of the session and perhaps from others in the K series will be published in due course in the *Symposia Studies Series* of the NISBS.

DONALD P. RAY,
Director and Program Arranger

Society for the Scientific Study of Religion (K8)

The Society held two sessions in conjunction with the Berkeley meeting of the AAAS on 27 December 1965.

Discussions focused on religion's role in the development of science, on the requirements for a scientific study of religion, and on the significance of recent developments in the social sciences for religious survival and change. Sharp disagreement developed over the validity of the proposition that the results of social science research pose an increasing threat to the survival of traditional religion. Evidence was examined for the proposition that Roman Catholic rather than, as more commonly thought, Protestant sources provided the initial stimuli for the development of modern science. A critique of past conceptualizations of religious commitment and a proposal for reconceptualizing the phenomenon were presented. The relation between religion and tension management among sport parachutists showed that theological factors are still significant determinants of religious participation.

CHARLES Y. GLOCK,
Program Chairman

The three-and-one-half day symposium of Section O was concerned with ground level climatology. On 27 December the ecological significance of climatic elements in forestry was discussed. The point of major discussion of the session was the relation between results obtained in controlled environment chambers and experimental field trials—the problem of a few carefully controlled factors versus the interaction of all factors in the field, and in field studies the selection of the proper meteorological parameter.

The Interdisciplinary Symposium on 28 December discussed "The implications of weather modification." Up to the present time there seems to be little positive proof of modification except on a relatively small scale. However, the possible ramifications of weather

modification on ground level climatology may be tremendous and need to be examined for the maximum economic benefit.

Two half-day sessions were held 29 December on the ecological aspects of ground level climatology to plants. In the morning session the regional analysis of selected problems was presented. The importance of evaluating the interactions of physical and biological factors was emphasized. The afternoon session on applications of ground level climatology examined four specific problems in detail and the results which have been obtained.

The final day's sessions on 30 December were devoted to ecological aspects of ground level climatology to animals. "Animal climatology" was discussed in the morning session with emphasis on physiology and performance of animals in hot and cold climates. The afternoon session was devoted to climatic physiology with climatic effects on the physiological performance of animals as the theme.

HAROLD B. SPRAGUE,
Secretary

Seven papers were presented in the session on ecological aspects of ground level climatology on the physiology and performance of animals.

Major emphasis in most of the presentations was the interrelation of environment to physiology and performance. Basic physiological effects or responses of domestic animals to microclimates were discussed from the heat balance point of view. Emphasis was also placed on the mechanisms by which environment may effect reproduction of sheep, and circulatory compensations as related to heat balance. The modification of the micro-environment by shelter engineering for cattle and swine was fully described. Relative effects of micro-climate in terms of temperature, radiation, humidity, and air velocity to physiology and performance of cattle, swine, poultry, and sheep were emphasized throughout this session. A need was generally demonstrated for the formation of teams to scientifically pursue micro-meterological investigations on animal physiology and performance, the need for climatologists, physiologists, engineers, and production specialists of the various species to join in these efforts.

As breeds are improved genetically and by nutrition for greater production, a concern was expressed to know the ideal micro-environment to enable full genetic expression of the animal.

HAROLD JOHNSON,
University of Missouri

History and Philosophy of Science (L)

Science Courses for Baccalaureate Education Project (L2)

Through the financial support of the Charles F. Kettering Foundation, a substantial effort has been underway to develop a new approach to the teaching of science to college students who plan professional careers in law, government, philosophy, economics, anthropology, sociology, history, education, and other fields. The activities are centered at Rensselaer Polytechnic Institute of Troy, New York, with participation of faculty from many colleges and many disciplines. Two experimental classes have been in progress for developing the new approach—one with architecture and management science freshmen at RPI and the second with liberal arts freshmen at Russell Sage College.

The chairman of the project and of this session (28 December 1965), V. L. Parsegian, reviewed the history of the project and the table of contents being followed by the 2-year sequence. The course emphasizes ideas, concepts, methods of science, historical features, and interrelationship of sciences. While disciplinary divisions are avoided, the topics are organized to permit a physicist to teach the first year of the course and a biologist to teach the second year, each with some preparation. Textbooks and a teacher's guide are being developed for that purpose.

A unique feature of the new course is the early introduction of the systems, feedback, cybernetics concepts, and the probability, statistical features of natural phenomena. These constitute unifying themes throughout the 2-year sequence, equally useful in physical, biological, and social situations.

K. M. Thomas (RPI) and K. Scott Kinerson (Russell Sage College) discussed the difficulties and successes of the pilot class experience. Results have been highly encouraging on the feasibility of an integrated approach to topics from the fields of physics, earth sciences, astronomy, chemistry, biology, with bridges to the social sciences.

Henry Margenau (Yale University), an advisor to the project, presented ideas that should be impressed on every college student. Science and scientific effort constitute a continuing search for truth rather than embodiment or achievement of absolute truth. All knowledge, whether from physical or social areas, begins with qualitative enquiry and progresses toward quantitative research. While science is said to deal with facts alone, the speaker pointed out that there is no contrast between the realm of values and the realm of facts.

V. L. PARSEGIAN,
Chairman, Science Courses Project

Society for General Systems Research (L3)

A review of the significance of the papers and discussions at sessions of the Society for General Systems Research shows a distribution between four levels of communication. Four papers were primarily aimed at improving public understanding of the utility of systems theory for dealing with urgent public problems. Sixteen were focused on the application of systems theory to decision-making in business, government, education, and research. Ten dealt with definitions and correlation of concepts and processes in different fields of science as aids to interdisciplinary communication. Four papers had relevance to multidisciplinary research where a scientist must grasp adequately the differing concepts of several fields of science in order to maintain perspective of his research problem.

Examples of papers relating to public understanding of the application of systems concepts are S. Chandrasekhar's application of systems concepts to the population explosion problem in Southern California, and A. Rapoport's presidential address using systems concepts to examine the viability of our national political-military system and its relevance to survival of human civilization.

On the decision-making level, R. O. Gibson pointed out how general systems analysis can increase the prob-

ability of constructive interaction between knowledge systems and value systems so the "is" and the "ought" can come together in a mutual dialogue and critical examination. In one of the papers on augmenting psychiatric services, J. A. Starkweather reported on using a computer typewriter terminal for screening interviews in which the computer program simulated a psychiatric social worker in the intake interview.

On the third level of interdisciplinary communication, J. G. Miller presented information input-output curves for cells, organs, organisms, groups, and organizations which showed an analogous form for each level of organization. The papers from Ohio State established a logical base for use of concepts from set theory, information theory, graph theory, and general systems theory in educational research. Members of the mathematics panel cautioned against confusing increasing numbers of applications of general systems theory with advances in fundamental theory.

An interesting example of the fourth level or multidisciplinary stage was S. C. Dood's hypothesis on a probabilistic-interacting mathematical generating function, which when given certain assumptions, predicts the size of the minimum elements in the following families of systems: entropic, gravitational, energetic, material, living, human, social, and systematizing systems. It may take a number of years to develop acceptable tests of such a hypothesis.

In several discussions it was pointed out that the concept of negative feedback or the detector-selector-effector loop inherent in general systems has now made the study of goal-directed behavior acceptable to "hard" scientists. In a summarizing session, L. von Bertalanffy pointed out that general systems theory is potentially a new natural philosophy in that it looks at the universe as an organization, instead of a world of chaos.

FREDERICK B. WOOD,
General Chairman

Engineering (M)

Systems Engineering in Agriculture

This symposium, held on 29 December 1965, was part of the Section M program.

Agriculture has become a complex undertaking where man, machines, biological systems, and environment must interact to produce food and to make a profit. New approaches to systems optimization have proven effective in the military and industrial sectors. These approaches are being adopted by agricultural engineers seeking to create more effective systems of food and fiber production.

The purpose of the symposium was to consider how the successful systems methodologies used in industry and the military can be employed in design of complex agricultural systems.

Thomas H. Rockwell (Ohio State University) described how computer simulation is used to optimize an inventory problem requiring rapid and flexible management decisions. A community blood bank was studied as an example, and possible uses of such simulation in agriculture were described. Seth Bonder (University of Michigan) showed how operations research methods are used to prepare design models of new armored weapons systems. The design models were then used in simulated dynamic combat situations. Several analogies between the performance of track-laying military vehicles and the prime movers of agriculture were brought out.

H. N. Stapleton and K. K. Barnes (University of Arizona) discussed mathematical modeling of systems of cotton production. They conceived a new "figure of merit" methodology to aid management judgment. However, they recognize a painful lack of coefficient data which are needed for use in systems models. David A. Link (North Carolina State University, Raleigh) showed how activity network techniques can be applied to stochastic networks, such as farm machinery scheduling and management. Techniques such as CPM and PERT cannot be transferred directly to these agricultural systems but can be modified into useful aids for decision-making. Kenneth Von Bargen (University of Nebraska) described how systems engineering is used to optimize production of alfalfa hay from 4000 acres. Various combinations of men, machines, and materials were allowed to interact with weather to gain knowledge and data for generalized systems analysis and engineering.

The lack of reliable data (physical, chemical, biological, economic) is now hampering a large part of the systems engineering effort. Formulation of reasonably adequate models has proceeded very well but the variation in output of the models is still too great because of missing or inadequate data.

The arranger of this symposium is grateful to Charles F. Savage and Newman A. Hall (chairman and secretary, respectively, of Section M) for encouraging the idea of the symposium.

ROBERT E. STEWART,
Program Arranger

Medical Sciences (N)

Alpha Epsilon Delta (N1)

A symposium on the "Preparation for the practice of medicine in the next decade," was sponsored by Alpha Epsilon Delta, the International Premedical Honor Society (29 December 1965).

The image of the "family" doctor may return in the next decade but he will be somewhat different. He will probably be a specialist in health care, according to C. C. Cutting (Permanente Medical Group). He envisions large "health centers" as distinct from hospitals. The result will be a new type of doctor, the general physician, "an expert trained and motivated in predictive medicine, preventive medicine, health maintenance and a coordinator among the specialists—a sort of anchor man."

"The application of the increasing body of knowledge in the basic sciences to the treatment of human disease obviously is lagging behind the acquisition of this information, but much of it will undoubtedly be applied to medicine over the next 10 to 15 years. The students who are in training at the present time will most certainly have to use much of the new information in their practice in the future," J. H. Githens (University of Colorado School of Medicine) pointed out.

The College of Arts and Sciences, as always, must continue its responsibility of giving the students the broad and liberal education that is so necessary in the practice of any profession. The competition for admission to medical school will probably not change too much and much responsibility for this will rest with the premedical advisors. Everyone is concerned about the qualified students who are not able to be admitted because of lack of vacancies in the medical schools. Concern

was voiced that we keep the ratio of physicians to population as near as possible to what it is today and that the quality of our medical care does not suffer because of the changes.

There are advantages and disadvantages to "Medicare," as reported by D. L. Wilbur (American Medical Association). Although he opposed Medicare, he will support the law, whose long-term "disadvantages will probably outweigh its advantages. It will make medical care available to persons who have not sought it and have not got it because of financial or other considerations. One of its long-term advantages" he suggested, "will be a tremendous educational upsurge in the allied health professions."

Other participants included H. S. Jacoby (University of Pacific), R. Cohn (Stanford University School of Medicine), and J. B. de C. M. Saunders (University of California School of Medicine). Norman F. Witt (national president, Alpha Epsilon Delta) presided.

Alpha Epsilon Delta has sponsored a program on some phase of medical and dental education at the meetings of AAAS almost yearly for the past 20 years.

MAURICE L. MOORE,
Secretary

American Physiological Society (N3)

During the symposium on "Oogenesis and early embryonic development" (28 December 1965) the formation, function, and fate of the annulate lamellae in oocytes and embryos of invertebrates was considered by R. G. Kessel (University of Iowa) and F. H. Moyer and C. A. Verhey (Washington University, St. Louis). The annulate lamellae, derived from the nuclear membrane at specific times during oogenesis, remain in a stacked array in the cytoplasm until they dissociate upon the commencement of protein synthesis. Ribosomes were present, in some cases, upon the stacks of annulate lamellae. It was suggested that the origin of the annulate lamellae was a method for the conveyance of material formed in the nucleus into the cytoplasm and its storage there until required by the cytoplasm for its functioning.

K. D. Smith and H. Ursprung (Johns Hopkins University) demonstrated that the cytoplasm of mature eggs of tunicates may be spatially differentiated with respect to mitochondria, endoplasmic reticulum, and lipid droplets. Thus the unfertilized egg has become specialized for future functional capacities prior to entry of the sperm. Smith and Ursprung also demonstrated that the fertilized egg is capable of considerable growth and cell division without the concurrent expression of the DNA. This evidence suggests that the unfertilized egg contains, in its cytoplasm, information in the form of messenger RNA for controlling protein synthesis in the developing embryo after fertilization.

The possible location of mRNA within vesicles derived from the annulate lamellae was suggested by F. H. Moyer and C. A. Verhey. They have found that these vesicles disappear after fertilization while the synthesis of proteins is increasing. Thus, the mRNA which controls protein synthesis after fertilization is presumably synthesized in the unfertilized egg and enclosed in the vesicles to prevent its destruction prior to fertilization.

The relation between growth, differentiation, and protein synthesis was also examined in more fully developed embryos of the brine shrimp, *Artemia salina*, by J. S. Clegg (University of Miami, Coral Gables, Florida). Unlike most embryos, these forms undergo an extensive period of development during which embryonic differentiation occurs in the complete absence of cell division. It was shown that extensive protein synthesis does occur during this time but that the extent of RNA synthesis was either slight or absent. This suggests that later embryonic stages, at certain times, might also be capable of further development without the concomitant DNA-directed synthesis of mRNA.

This symposium was arranged on behalf of the American Physiological Society and Section F of the AAAS by R. M. Iverson (University of Miami) and R. E. Smith (University of California, Los Angeles).

R. M. IVERSON,
Program Arranger

Dentistry (Nd)

A symposium (27 December 1965) on the subject of the "Behavioral sciences in dentistry" was held at the AAAS annual meeting in Berkeley, California. The program brought together participants who reported on their studies of stress and fear, interdisciplinary approaches to a variety of relevant problems, and the development of the behavioral sciences in the general context of relevancy to dentistry.

The basic work on psychological stress indicates that the anticipation of stress is very important. Using physiological measures as indices of arousal, it was clearly shown that the subjects' maximum response occurs prior to stress. With the occurrence of stress, there is a rapid drop in the indices of arousal. This basic finding seems to be in keeping with the study which showed that children have a marked response to being told that they were to have a tooth removed. Here again marked response occurred during the anticipatory period and tended to disappear following the stress removal of a tooth. However, the latter study also showed that children reacted less favorably to oral surgery when the anticipatory period was very short. The role of psychological stress as a factor in oral disorders was also discussed. Early studies indicate that such stress may be a factor in the production of cleft palate. Psychological stress also appears to be a factor in some disorders of the gingival tissues. New sophisticated techniques now being developed for the recording of physiological changes in oral tissues were described.

The research on experimental fear reduction shows that subjects can be desensitized to a specific fear; that this desensitization lasts; and that, subsequently, there is a tendency for subjects to be less fearful in general. The importance of this basic work to dentistry is obvious, as is the need for more knowledge of fear in the dental situation. The theme was developed that the dental situation presented an ideal natural situation for studies of some basic psychological phenomena such as stress, fear, and pain. This point was well illustrated in the paper on reduction of pain through audio analgesia, where the dental situation was used for a behavioral study. Here the volume of the white noise was found to be the important variable in control of pain.

This symposium—the first of its kind—emphasizes the importance of the behavioral sciences to the field of dentistry, and the need to bridge the void that exists between activities in basic research and their application at

the clinical level of patient care and therapy.

The symposium was cosponsored by Section K (Social and Economic Sciences, Section I (Psychology), and Section N (Medical Sciences); and by the American Dental Association, American College of Dentists, International Association for Dental Research (North American Division), and the American Society of Oral Surgeons.

G. T. PHIPPS,
Program Arranger
S. J. KRESHOVER,
Secretary

Pharmaceutical Sciences (Np)

Section Np held 12 sessions which included 32 contributed papers, 2 symposia, and the Section Np's distinguished lecture. An interdisciplinary symposium on Materials Science in Dentistry, Medicine, and Pharmacy was held on two consecutive mornings and was arranged by John Autian (University of Texas) and Col. Peter M. Margetis (U.S. Army Medical Biomechanical Research Laboratory, Walter Reed Army Medical Center).

The Materials Science Symposium was divided into two parts with three speakers presenting their talks for each of the sessions. On 28 December R. I. Leininger (Battelle Memorial Institute) introduced the subject and then discussed research dealing with the development of nonthromobenic surfaces. Fred Leonnard (U.S. Army Medical Biomechanical Research Laboratory) reviewed the advances in the use of plastic materials for implants and emphasized the new adhesive agents which might be used in surgery. Patrick G. Laing (University of Pittsburgh) described several of the problems in the use of various metals for prosthetic devices.

In the second session (29 December), R. W. Phillips (Indiana University) reviewed the progress in the development of dental materials and noted several present and future problems with materials which the dental practitioner might face. John Autian (University of Texas) discussed a number of problems in the use of plastic materials for various devices and suggested steps for the development of a group of standards for these materials and devices. The attitude of the Food and Drug Administration on materials for medical and paramedical applications was emphasized by Earl L. Meyers (Food and Drug Administration).

The hospital pharmacy sessions consisted of 12 contributed papers. Jack S. Heard (Marin General Hospital) discussed the use of the physician's original orders within the hospital for obtaining medication, thus eliminating the need for transcribing orders. George F. Archambault (U.S. Public Health Service) stressed the dangers of drugs used for self-medication and reemphasized the need for accurate information concerning the toxicological properties of the constituents of these products. Eric Owyang and Thomas Piepmeyer (University of California Medical Center) presented data on the sodium content of 100 drugs and drug products that might possibly be used by cardiac patients on low-sodium diets.

John E. Christian presented the vice-presidential address, "Future dimensions of the pharmaceutical profession," and emphasized the effects of extended medical care for all on the various facets of pharmacy.

Contributed papers in the areas of pharmacology, physical pharmacy, pharmaceutical chemistry, and behavior were presented during two sessions. Eugene C. Lee (Oregon State University) presented data showing that moist cold is a germination requirement for *Heracleum mantagazzianun*. Paul H. Kopper (Washburn University, Topeka, Kansas) discussed the fibrinolytic properties of a dialyzable constituent of recalcified human plasma clots with rabbits as the test animal. Anwar A. Hakim (Armour Pharmaceutical Company) differentiated the collagenolytic activity of bacterial and pancreatic collagenase. James A. Dingwall (Squibb Institute for Medical Research) discussed the physiological activity and therapeutic effectiveness of processed heterogenous (calf) bone and presented data showing that processed heterogenous bone was relatively nonantigenic. Junius W. Webb (Food and Drug Administration) showed that as the dose of mesidine was increased in rats the amount of DNA per gram of liver increased proportionately, and suggested that this could be used as a measure of early toxic response. Dimitris Papandrianos (Colgate-Palmolive Research Center, New Brunswick, New Jersey) presented a new quantitative method for evaluating compounds for decongestant activity in vivo. Four papers were presented on 2,3,5-triiodobenzoic acid (TIBA) by J. H. Ware and A. G. Ebert (International Minerals and Chemical Corp., Skokie, Illinois) and John E. Christian (Purdue University). This compound has potent growth-regulating activity in certain plants; these investigators presented data on the detection and occurrence of TIBA in plant tissue and the distribution and metabolism of this compound in rats and plants. Elmore H. Taylor (University of Tennessee) discussed the biosynthesis of certain ergoline alkaloids in homogenates of tomato fruit, potato sprouts, and morning glory seedlings. R. M. Small (Eli Lilly and Company) presented data showing that the polymeric material, ½ isopropyl ester of poly (vinyl methyl ether/maleic anhydride), was nontoxic and concluded that there was no evidence that ingestion of this polymeric coating poses a toxic hazard to humans. Gerhard Levy (State University of New York at Buffalo) reported that the absorption rate of certain barbiturates (in goldfish) was significantly increased in the presence of low concentration of polysorbate 80 and decreased by high concentration of the surfactant. N. S. Dhalla (University of Pittsburgh, School of Medicine) presented data on in vitro studies showing that the activation of phosphorylase has no cause or effect relation with overt heart function. Joseph P. Buckley and B. S. Jandhyala (University of Pittsburgh, School of Pharmacy) discussed the possibility that an increased release of epinephrine from the adrenal medulla and sensitization of beta-adrenergic receptors in the vasculature contribute greatly to the overall hypotensive activity of cryptenamine. Glenn H. Hamor (University of Southern California) discussed the hypotensive activity in cats and dogs of nine saccharin analogs of chlorthiazide. Fred Damarin (Educational Testing Service, Princeton, New Jersey) presented a paper on the effects of thyroid deprivation on EEG and behavior in humans. The most consistent and thus statistically significant effect of thyroid deprivation was the slowness in solving numerical problems (decreased numerical facility). W. Marvin Davis (University of Mississippi) discussed the effects of stimulants, including amphetamine, on the activity of different strains of mice and concluded that there was a great variance in activity of the compounds depending upon the strain used. C. L. Huang (University of Mississippi) stated that although many salicylates do not influence the

metabolism of chlorpromazine certain analgesics did significantly increase the concentration of unmetabolized chlorpromazine in the blood. Erica Spurdle (Bureau of Research in Neurology and Psychiatry, Princeton, New Jersey) reported that adrenochrome semicarbazone protected mice against shock from colon bacillus toxin, and treatment with the compound also prolonged the onset of symptoms of anaphylaxis.

Bernard B. Brodie (National Heart Institute) presented Section Np's distinguished lecture entitled "Biochemical aspects of mental disease." He discussed the possible role of neurotransmitter, storage of catecholamines in nerves and nerve endings, and the importance of cyclic AMP.

The officers and representatives of the sponsoring societies met to elect new officers and to formulate the program for next year's meeting. Andre Archambault (University of Montreal) is the new vice president and chairman of Section Np for 1966, and Lee H. MacDonald (Upjohn Company) was elected committeeman-at-large.

Lunch, reception, and dinner were sponsored by E. R. Squibb & Sons, Wyeth Laboratories, and McKesson and Robbins, respectively.

JOSEPH P. BUCKLEY, *Secretary*

Agriculture (O)

The attendance at the seven sessions of the Section O program totaled almost 600. Six of the seven sessions were made up of invited papers designed to cover the salient features of ground-level climatology. One session consisted of contributed papers, in this same field, but limited to forestry aspects.

The retiring chairman of Section O, Robert H. Shaw, has been designated as a committeeman-at-large for a 4-year term. The 1966 chairman for the Section is N. C. Brady (Cornell University). The program for the 1966 meeting in Washington, D.C. is "The Agricultural Aspects of Pollution"; Brady will develop this program. It will encompass soil, water, plants, animals, foods, and feeds. H. B. Sprague has completed two 4-year terms as secretary of Section O; and his successor is Ned D. Bayley (U.S. Department of Agriculture).

H. B. SPRAGUE, *Secretary*

Industrial Science (P)

Section P conducted two meetings on 29 December 1965. In the morning session, chaired by Ralph W. Gerard, the present and potential roles of computers in universities were presented. Gerard indicated some of the experiments that are being conducted at the University of California, Irvine, to determine the potential use of computers in aiding instruction.

Fred M. Tonge presented some potentials of computer-assisted instruction and implications of computer technology in both instruction and administration. George E. Forsythe described the research, educational, and professional problems associated with the establishment of computer science departments in universities. Martin Cummings described the opportunities which exist to computerize libraries to serve research and educational needs of universities. Robert D. Tschirgi recommended the use of technology in the establishment of communication networks to interconnect universities, industry, government, and libraries.

At the section's luncheon meeting, the Industrial Science Achievement Award was presented by Burton V. Dean to Stanford University in recognition of the university's contribution to industrial science through its educational and research programs.

In the afternoon, J. C. R. Licklider described the interaction of man and the computer in the gathering and use of information. Walter M. Carlson described how information is used to assist individuals in the Department of Defense. Carl F. J. Overhage described plans for conducting experiments on the transfer of information.

BURTON V. DEAN, *Secretary*

Education (Q)

The first session of Section Q was a program of contributed papers (26 December). Morris Goran discussed the similarities of science and art. He emphasized, particularly, the similarities in harmony and order. Scientific theory displays the cohesiveness and logical beauty that one finds in the masterful whole of a work of art. The two aspects of science—analysis and experience of discovery—must both be taught so that the student experiences an emotional impact from the beautifully put-together theory. For the experience of discovery it seems that curiosity has been overstressed and in its place the emphasis should be on imagination and speculation. The ability to look at data in a new way exemplifies this imaginative skill.

A research study by Steven Ross, a medical doctor, supports Goran's philosophic point of view. He stresses that the college medical doctor must practice medicine, must do research, and must teach. This is probably correct for most of the academic disciplines. Teaching tends to be based on tradition rather than on research or ingenuity and imagination. One cannot avoid the emotional problem connected with the teaching process. Ross's study seemed to show that the learning of just the basic anatomical parts of the area that the average doctor needed achieved better results than a control section in which the anatomy was taught in great detail. Is there a workable minimum knowledge that can be attained in any given field, and which will allow additional time for imagination and speculation?

If research is to supplant tradition in teaching practice, perhaps William Ternent is correct in his analysis of the writings of scientists and engineers. He would suggest that their writings are verbose, turgid, and unimaginative. Ternent would suggest that one should write to sell the product—the research. Therefore, more imagination should be exercised in thinking through the strategy of inviting to sell and the organization of the article to achieve the strategy.

FREDERICK B. DUTTON, *Secretary*

International Science Teaching

In the first symposium on International Science Teaching, eight papers were presented which reflected a wide range of activity in science education reform throughout the world. The most significant facts that emerged were: clear recognition of the need for keeping science teaching up-to-date in both the "developed" and the "developing" countries, and understanding of the many complex factors which are involved.

The symposium, arranged by Arthur H. Livermore (AAAS), was chaired by Arthur Roe (National Science Foundation).

Isaias Raw (Instituto Brasileiro de

Educacao, Ciencia e Cultura, Sao Paulo, Brazil) discussed the rapid progress of science education in Brazil during the past 15 years. He emphasized the fact that the reform had been initiated by scientists but could not have been successful without the cooperation of the Ministry of Education, and the direct assistance of such organizations as UNESCO and AID.

The first goal was the secondary school where science teaching had been frozen into a traditional pattern, and teaching of science and mathematics reflected an era which had passed. Raw, himself, has led the reform which has centered on providing the means for students to participate in their own science education. This has been accomplished through many approaches—science clubs, Science Fairs, the supplemental training of teachers in modern science and science teaching, but, most important of all, through the development and manufacture of simple and inexpensive science teaching equipment, including individual kits, which can be made available to most schools and to most students. The activities of IBECC, now well known throughout the world, have broadened to include translation and adaptation of modern science textbooks, films, and other teaching aids. The measure of success was reflected in the establishment, by the Government in 1965, of five regional centers for science education.

In addition to attention to science education at the university level, IBECC now sees its major responsibility as improving science teaching at the elementary school level not only for its importance in preparation for future academic study but also for the betterment of life for the millions of Brazilian children who will terminate their formal education at an early age.

Raw emphasized the importance of cooperation with scientists and science teachers from other countries in the Brazilian enterprise and expressed the hope that such international cooperation can be greatly expanded.

Harold Behrens (University of Chile), one of the early leaders of science education reform in Latin America, presented impressive figures on population growth and its implications for science and technology, which depend, in the long run, on the effectiveness of science education. Behrens emphasized the handicaps under which developing countries work in their efforts toward technological development. Important among these is the small number of motivated scholars who can lead the reform to provide the rapidly growing number of teachers needed to teach in the burgeoning schools.

Behrens described an academic-year course which he will direct at the University of Chile, under NSF and AID auspices, for a group of carefully selected leader-teachers of chemistry from Chile and other countries. The group will study modern chemistry, participate in on-going research projects in the chemistry department, and prepare model units of study for use in high school chemistry teaching. The course will begin in March 1966.

Jesse Perkinson (Pan American Union) reported on "Foreign assistance to science education in Latin America." Perkinson emphasized the growth of interest in the reform of science education in most of the Latin American countries and the rapid progress which has been made during the past few years. Factors which have made this progress possible include the development of strong leadership among the professors of science and mathematics in the universities through participation in related activities in the United States and, more recently, through participation in national and regional activities in Latin America. Perkinson stressed the relatively large amount of financial assistance for science development in Latin America from a number of outside sources, including such international organizations as the Pan American Union and UNESCO, private foundations, AID, international banks, and others. It has been estimated by International Scientific and Technological Affairs, Department of State, that outside support for science development through grants for the years 1960–62 amounted to approximately $78 million. An important effect of this assistance has been to influence the universities to modernize themselves and to bring them closer to the problems of science education reform at all educational levels. In this way, bonds between the scientists in the universities and officials in the Ministries of Education are being strengthened. A visible reflection of the movement for science education reform in Latin America is the rapid growth in the number of special vacation training courses for science teachers that are being initiated within the countries themselves.

Amanatollah Rowshan-Zaer (University of Tehran, Tehran, Iran) presented an interesting paper on factors influencing the rapid development of science education in Iran, some budgetary information, and the organization of education in Iran. Rowshan-Zaer pointed out that although science has been taught in an organized manner in Iran for only about 30 years, rapid progress is now being made because of the wise leadership, constant attention, and valuable moral and material support of His Majesty The King of Iran. This leadership is the more effective because of the receptivity of Iranian youths' minds owing to a highly developed background. That Iran is making a major effort can be seen in some budgetary figures. At the present time, it is estimated that the investment in education and manpower development is around 5 percent of the national income. The total annual budget of the University of Tehran is about $15 million, and the budget for secondary school and university education during the period of the third development plan (1962–67) is approximately $395 million.

Special efforts now are being made to improve the training of science teachers and to encourage secondary school students in the study of science through projects in which they make some laboratory equipment and simple machines. The effectiveness of this activity could be seen in an exhibition of some of these materials which was held during the past year.

Rowshan-Zaer pointed out that at the present time Tehran University's College of Education in collaboration with the Colleges of Letters and Science are making a strong effort to develop and adopt the best modern methods and material for the training of future science and mathematics teachers.

(Dr. Rowshan-Zaer and three colleagues at the University of Tehran—Yahya Abdoh, chemistry; Pezeshkpour Mostachfi, biology; and Ali-Naghi Vahdati, mathematics—are making an extensive study of science education in the United States under the auspices of the Fulbright program.)

Ernest Burkman (Florida State University discussed "The National Science High School Project of Turkey." Burkman and his colleagues, working under the direction of J. Stanley Marshall (College of Education) have provided technical support for the project, which is sponsored by the Ford Foundation and the Turkish Ministry of Education. The school, in a new, completely equipped building, is in its second year of operation. The faculty,

with special training in the teaching of modern science and mathematics, works closely with a committee of Turkish scientists. The teaching materials for science and mathematics consist of special adaptations of new U.S. materials. These adaptations have been made on the campus by Turkish and American scientists and science teachers working together. Summer training courses for groups of Turkish high school science and mathematics teachers are also conducted at the school, and plans are being made to extend the influence of the school in a number of ways with the ultimate aim being to help improve the teaching of science and mathematics in the country in general.

Jack S. Goldstein (Brandeis University) discussed the progress being made in the African elementary school science project administered by Educational Services Incorporated, with support from a number of sources including the United States Agency for International Development (AID), the Ford Foundation, and the Louis and Pauline Cowan Foundation. In particular, Goldstein described the summer workshop which he directed in Entebbe, Uganda, in 1965, attended by selected representatives of the primary schools of the Tropical African Countries. The three objectives of the workshop were: (i) to develop primary school science units, (ii) to exchange information about primary school science activities from the countries represented, and (iii) to develop a corps of people from each country who would be equipped to staff school science resource centers in each of the countries. Goldstein noted the eagerness and ability of the African students and teachers and the tremendous problems which must be overcome in each of the countries.

Claude A. Welch (Michigan State University) related observations on science education made during a visit to Japan in the summer of 1965 in connection with the U.S.-Japan Cooperative Science Program. Welch described Japanese progress in translating and adapting biology teaching materials developed in the United States by the Biological Sciences Study Committee. He also discussed the network of science teaching centers which have been established in Japan where a wide range of activities, from the preparation of science teaching materials to the supplemental training of science teachers,

take place. Of special interest was the rapidity with which the Japanese are adapting their programs of science education to the needs of the time.

Eric M. Rogers (Princeton University) discussed United Kingdom efforts to improve science teaching through the work of the Nuffield Foundation. Rogers presented an analysis of the present state of science education in the United Kingdom and of reforms which must be made. The various projects of the Nuffield Foundation in this respect were described. Rogers pointed out that the basic change which must come about is the point of view from which the study of science must be approached—from the traditional attitude that the study of science is aimed toward learning to the view that science is studied for understanding.

HOWARD F. FONCANNON,
National Science Foundation

Piaget's Research and Its Implications for Science Education

This symposium was a joint session of Section Q and the National Association for Research in Science Teaching (27 December 1965).

"A preliminary report on the performance of 5th and 6th graders on a directed learning task: the pendulum," was presented by Maurice Belanger. Another paper, "Interrelations of the acquisition of some Piaget-type tasks requiring proportional thinking," was presented by Ronald Raven. The paper by Belanger is just a small section of a monograph which he is in the process of writing. Therefore some of his conclusions were still tentative. However, it was interesting to learn there is such a thing as "boy physics" as well as "girl physics"; that girls seem to have greater rigidity to change than boys; that boys, rather than girls, are much more receptive to data collected by experimentation. These represent just a few of the inferences which Belanger has been able to make from his studies. Raven found from his research that maturation plays an important role in the ability to use proportional thinking.

Interrelations of the acquisition of some Piaget-type tasks requiring proportional thinking in primary school children was one of the subjects covered during this symposium on Piaget research. Inhelder and Piaget have shown that there is a gradual evolu-

tion in the process of proportional thinking. His paper reports the results of an investigation of children's thinking within the first and second proportion schema. In the first stage, the child is able to see the relationship between the changes of one variable and the proportionate changes of the final results. Thus, he can predict that an increase in the height of an inclined plane will produce an increase in the speed of an object moving down the plane. During the second stage, the child comprehends that an increase in one variable can be compensated for by reducing or increasing another variable. For example, we can hold the speed of a car constant by increasing the angle of an inclined plane even though we have placed the car lower on the plane.

The purpose of this experiment was to determine what the effects of two different rules were on the ability of the child to manipulate the variables governing the speed of objects down the inclined plane. In the first experiment, six-, seven-, and eight-year-old children used the rule that the speed of an object down the plane was directly proportional to the height of the object on the plane and the angle of the plane. Weight was not a factor in determining the speed of the object. In the second part of the experiment, children of the same age group were using the rule that the speed of the object down the inclined plane was directly proportional to the weight, height of the object on the plane, and the angle of the plane. The car was adjusted so that an increase in weight would make it go faster contrary to "accepted" laws of physics.

Six- and seven-year-old children had more difficulty excluding the weight as a variable than did the eight-year-old children. Even though the first rule involved only two variables, the children scored consistently higher on problems dealing with the rule involving three variables. It is to be noted that all the children had previously been operating by a rule that lighter things go faster. The second experiment made them operate by an opposite rule that heavier things go faster. In spite of the unusual nature of the latter rule, the children still preferred to operate by it rather than exclude weight as a factor determining the speed of objects down the plane. It would appear that children have formed a strong relationship between weight and speed. The results of the experiment show

that the rules governing the relationship are not altogether perceptual in that the children were able to successfully use a rule that contradicted their perceptual experiences, that is, heavier things go faster. However, the weight-speed relationship was not easily extinguished until the third grade although the rules governing this relationship were easily changed at the first and second grade levels.

Measurement of Quality in Education

During this symposium (29 December), all participants generally accepted Allan M. Cartter's opening comments that "quality" is an elusive term and that we are living in an age of public accountability. Using chemistry as an example, Cartter described a "subjective opinion study" of graduate departments of 106 major universities, involving ratings of graduate programs in 30 subject fields. The judgments of department chairmen, senior scholars, and junior scholars were tabulated independently and collectively for these groups. Judgments and subsequent rankings were made on the scholastic stature of the faculty of each graduate department and the general effectiveness of each doctoral program.

William Firman reported on a study conducted in New York state which involved ability and basic skills achievement measures of 70,000 pupils in 100 school systems. Analysis of the results of students tested at these grade levels (4, 7, and 10), with type of system, general ability level as indicated by I.Q., and socio-economic levels has led to a "mosaic of strengths and weaknesses" for each system and sets of achievement expectancy norms. Two general conclusions reported were that "good" schools tend to recruit teachers on a nationwide basis and have more faculty members with masters degrees; and, second, that holding power is positively related to the availability of special services.

Henry S. Dyer reported on pilot work which has led to the development of a plan to evaluate educational programs in Pennsylvania. Citing the act of the Pennsylvania legislature which calls for the development of this type of program, Dyer pointed out that the pilot work demonstrated that dialogue between laymen and school people on educational matters is possible. The plan calls for the involvement

of the public right down to the tests ultimately devised for use. It would yield expected outputs for schools of different types based on predictor variables over which the school system has control. The five salient features of the plan are (i) direct public involvement, (ii) continuous review, (iii) breadth of purposes, (iv) a cumulative program of research, and (v) encouragement of vital diversity.

Ralph W. Tyler discussed the work of the Exploratory Committee on Assessing the Progress of Education. He pointed to the value of descriptive type information provided during the depression by the reports of the National Youth Commision, and national measures in the fields of health and business; he noted that we do not have such information about the progress of education. He said a national assessment would differ from a national testing program in many ways. Each student would complete only a portion of the exercises and only a sample of students would be involved. There would be no scores or reports on individual students, teachers, or school systems. Rather, descriptive reports would be made on 192 populations based on four age levels (9, 13, 17, adult), four regions, two socio-economic levels, three types of communities (large city, suburban, rural-small town, and sex. Tyler cited the involvement of scholars, teachers, and public-spirited laymen in the deliberations of the committee and in initial steps toward instrument development.

Curriculum Development for Elementary School Science

This symposium was a joint session of Section Q, the National Association for Research in Science Teaching, and the American Educational Research Association (30 December 1965).

Joseph Lipson reported on how the Learning Research and Development Center of the University of Pittsburgh has for the past two years been engaged in the preparation of individualized science lessons for the elementary school. The individualized program depends on diagnostic pretesting and achievement post-testing of the abilities of the students so that no student is asked to learn objectives which he has already mastered and so that each student is assured of mastery of the objectives of the lessons he has had. In order to have an effective co-

ordinated program of lesson writing, materials development, test development, and program evaluation, the entire sequence is keyed to statements of what the student is expected to be able to do after each lesson or group of lessons. Lessons in which the student is asked to transfer his knowledge to new problems, discuss a problem with other students, or explore a new environment are built into the lesson stream.

Turning from the technical and pedagogic problems of lesson preparation for individualized instruction, we have concerned ourselves with forming a basis for deciding what should be taught in the elementary school science program, how the objectives should be taught, and the criteria of performance which the children should be expected to meet.

The lessons currently in use are based upon the AAAS process lessons and the lessons of the Science Curriculum Improvement Study of the University of California at Berkeley. It is proposed that the next step in curriculum development might go beyond the process objectives which enable the student to organize information and events over broad areas of science and general experience. The lessons of the SCIS (Science Curriculum Improvement Study) are in the domain which we have in mind. These lessons teach highly general basic concepts using experiences which are familiar to the student and which can be brought into the elementary school laboratory. Our proposal is that this program, integrating process goals and developing concepts of wide application and generality, be extended and at each point in the program we select those concepts which will most contribute to future learning and comprehension in science.

Concept learning in the elementary school has a special meaning in our lesson plan. By concept formation is meant that the student can identify a class of objects or events when shown a sample of objects or events (for example, when shown three triangles the student should be able to say that they are all triangles), and that the student can distinguish instances and non-instances of the concept (for example, which of the following figures are not triangles). This type of learning is emphasized because it is evident that children can gain command over many hundreds of concepts and that these concepts are resistant to forgetting.

Laboratory experiences are used as the basis for concept formation because of the observed persistence which children show in manipulative exercises; because we avoid many of the learning problems which arise when we attempt to teach scientific ideas with purely graphic or verbal means; because of the opportunity for self-initiated exploration which the laboratory materials provide; and because the properties to be observed cannot be fully displayed except in the laboratory setting.

Vocabulary plays an important role in the curriculum in order that the students can use a verbal sequence in applying the concepts to future problems; so that the instructor or the instructional materials can call forth the concept by the appropriate word; and so that at some point new principles can be taught by verbally indicating the relationship between previously mastered concepts. By building concepts upon verifiable, repeatable experiences we can ensure that the individual citizen can make a reasonable interpretation of events which have a scientific context. If properly chosen, the concepts will show a minimum interference of early learning with future learning.

In order to illustrate the steps which must be taken to implement the suggested program, a scheme of course design will be suggested; current experimental work in individualized education will be described insofar as it pertains to the theme of the talk. In particular, a comparison of grade school children and college freshmen will be reported.

Lawrence Lowery tested the reliability of a unit prepared by the Elementary School Science Project, and measured children's attitudes toward science, the nature of science, and the scientist. The tests consist of three parts which use the projective technique—Word Association Test, an Apperception Test, and a Sentence Completion Test. Reliability of the test was determined in two ways: (i) scoring between types, and (ii) the ranking of the same individuals 8 weeks later with no science being taught in the interim.

The reliability is greater than .90. The validity was established through an interface showing where students scored consistently through the three projective tests. Note the validity was never lower than .80 for the sub-tests. The weakness presented is that, al-

though these tests proved out, they are not to be used separately since all three are necessary before one may draw conclusions.

The final session of Section Q's program consisted of contributed papers (30 December). Paul Wittey (Northwestern University) summarized 15 annual studies of television-viewing habits of children and youth. Favorite programs and total viewing time were reported. Gains in vocabulary, changes in reading habits, relation to succession in school, and undesirable outcomes were among conclusions discussed. Philip H. DuBois reported on the statistical procedures by which statistical controls may be substituted for experimental controls in educational situations. The method involves (i) development of a hypothesis relating gain in proficiency to measurable traits; (ii) measurement of pertinent variables, including initial and final level of proficiency; and (iii) estimation of the relation between the primary variable and gain. Melvin P. Robbins (University of British Columbia) reported on a study which tested the Delacato conception for certain cognitive abilities in children. His study fails to support the Delacato hypothesis. R. J. Tritschler (IBM) reviewed the many problems faced by librarians in cataloging and retrieving printed materials. The potential solution through the use of computers was presented.

FREDERIC B. DUTTON,
Secretary

National Association of Biology Teachers (Q8)

Four sessions comprised the core of the NABT program. In the session, "Specific techniques in biology," Nicholas Eigsti (Ball State University) used yellow-green soybeans to show how genetic ratios can be taught as an open-ended experiment. Darwin Thorpe (Compton, California, College) showed how he used 35-mm slides to make vertebrate dissections more efficient. To show evolution, Marion S. Baran (Riverside-Brookfield High School, Illinois) explained how he innovated with plastic refrigeration containers to raise *Drosophila*. One of the problems with electrophoresis is its high cost. Sister Mary Ivo (Chicago Archdiocese) showed how she utilized simple and inexpensive equipment.

Another session, "BSCS and re-

search participation program," had Paul Geisert (Oak Park and River Forest, Illinois, High School) demonstrating his "think box," a skull into which students are encouraged to place questions. M. Cassandra Hickey (Medford, Massachusetts, High School) talked about her guide sheets which she used to help her students understand better the BSCS Yellow Version. In Oregon at Twality Junior High School, Arthur Biederman used his students as part of a NSF research participation ground squirrel study. And Gladys Kleinman (Rutgers University) explained her inquiry-oriented methods course to train nonscience oriented elementary teachers.

In a session, "Teacher training and resource use in biology," Tom Mertins and Jerry Nisbet (Ball State University) explained that their NSF summer institute stressed cytology, genetics, and biochemistry to fill the void of most secondary teachers. Kenneth Bandelier (New Haven, Indiana, High School) reported on his research which showed that teachers seldom made use of community resources. The necessity of keeping records of an organization, which can be made available for research, was stressed by Myrl Lichtenwalter (Wells High School, Chicago.)

In the last session, Alfred Novak (Stephens College) proposed a model college program for training future biology teachers, and Charles Ostrander (Merced, California, College) showed his device for obtaining immediate evaluation of student response to prepared questions. And finally, John Cunningham (Florida State University) explained how biological examples can be used to build science concepts in elementary students.

One of the most interesting and well-attended sessions was an "how-to-do-it" session where 20 teachers simultaneously demonstrated their pet ideas.

The highlight of the sessions was the NABT luncheon; Ralph Gerard (University of California, Irvine) talked on brains and learning.

HARRY K. WONG,
Program Chairman

Education (Q)

National Science Teachers Association (Q9)

The NSTA and the Central Association of Science and Mathematics Teachers (Q5) (CASMT) coopera-

tively planned sessions that were concerned with the rapidly changing patterns of science education at all levels, from the primary grades through college.

Sessions on science in the elementary school emphasized the great need for involving individual students in the process of science to achieve effective learning and for more open-ended experiments to help children understand the nature of science. One lecture presented methods for using closed circuit TV for observing and evaluating teaching techniques.

We should give more attention to the preparation of teachers and helping them keep up to date in science. The most important thing that a teacher should develop in college is a sound philosophy—of science, of science teaching, and of life in general. This philosophy is not usually what is taught in formal classes, but what is learned in the many classroom and life situations on the campus.

The session on science in the junior high school dealt specifically with achieving balance in teaching the physical sciences. One speaker showed how the earth and space sciences can serve as a unifying theme for teaching science. There is a lack of adequate emphasis on the laboratory in junior high school and a need for providing more adequate facilities and equipment.

Problems of teaching science in the junior college were also discussed. There is a need for more interplay between administrators and professors in 4-year colleges and their counterparts in the junior colleges. In some colleges an alarming trend away from emphasizing scientific literacy for general education is indicated through the decreased emphasis on science for general education and the increased emphasis on the separate disciplines.

There is an encouraging improvement in the academic quality of junior college teachers, often placing them on equal intellectual footing with the professors in the 4-year college. The junior college science staff is making commendable efforts to solve the problems of the wide range of ability levels among students and relieving the pressures of rapidly increasing enrollments. Although professors in junior colleges are giving an increasing amount of attention to research, teaching is their primary function and interest. This, together with the fact that the best teachers are teaching introductory as well as more advanced courses, creates a fa-

vorable situation for providing students with a sound introduction to science.

Several groups met to discuss specific topics related to science teaching in junior college. A report of these discussion groups is available on request from NSTA, 1201 Sixteenth Street, NW, Washington, D.C. 20036.

One of the problems facing teachers and administrators is that of effecting changes in teaching techniques and content in the classroom. In-service education and new techniques for evaluation provide excellent opportunity for accelerating these changes. One speaker discussed the role of education in our society and the potential assistance for change available at all levels of instruction through federal funds. In the future it is probable that increasing attention will be given to implementing changes and encouraging schools at every level to improve their instructional programs.

ALBERT F. EISS,
Associate Executive Secretary

Information and Communication (T)

Current Issues in Communication of Science II: The Scientific Meeting and Related Publications

The panel on Scientific Meetings (27 December 1965) observed that there are many purposes for scientific meetings; among the most constructive uses by scientists are: Reporting and learning about new research developments; surveying the state of the art of an area; personal contact, both professional and social; and building interdisciplinary bridges. These purposes are accomplished to varying degrees by the many types of meetings now offered.

However a great deal of both direct financial outlay and valuable time is now consumed by meetings. This has reached the point where the value of present meeting activities is being questioned with increasing seriousness. There is not any good method of evaluation and it is rather widely assumed or estimated that the return on total expenditure is small. The planning and sponsorship of meetings is moving from the scientific and professional societies toward the federal government and trade associations.

More clarity of objectives is needed in planning most meetings as is more care in setting structure in accordance

with objectives. In addition, the structure of systems of meetings sponsored by major societies and other organizations ought to be examined with objectives in mind. More carefully documented study of meetings with these matters in mind should prove valuable and the cost of such studies certainly should be returned manifoldly by the reduced expenditures and increased yield of value from meetings.

RICHARD KENYON,
Program Chairman

State of the Art and the Prospects for Data Gathering, Storage, Transformation, and Retrieval

The field of information transfer is in a phase of transition. In the session, 29 December 1965, on "Data gathering, storage, transformation, and retrieval," Walter M. Carlson (Department of Defense) presented recent findings that show local and informal transfer (face-to-face and telephone communication, personal and office files, and others) predominate markedly in frequency of use over formal transfer involving national or regional libraries, bibliographic services, document-retrieval systems, and journals. Carl F. J. Overhage (M.I.T.) then outlined the program of research (Information Transfer Experiments) recommended by last summer's Planning Conference to improve informal transfer and introduce into formal transfer some of the convenience and quick responsiveness that have heretofore characterized informal but not formal transfer. The Intrex program calls for a melding of the concepts of library and multiple-access (for example "time-sharing") computer and, in accordance with Carlson's philosophy, an emphasis on the needs and points of view of the users of information. In the final talk, J. C. R. Licklider (IBM) focused attention upon the prospects for "on-line information networks" in which systems similar to Intrex in various parts of the country (or of the world) will be interconnected through telecommunication channels. He adduced support for the ideas that the technological bases (storage, transmission, processing, display, and so forth) for such systems are rapidly coming into being and that much of the research and development during the next few years aimed at a "national information system" should be directed toward on-line networks in which "content" as well as document-retrieval (that

is, "bibliographic-control") information exists, and is used, in computer-processible form. Discussion ranged over a broad field—browsing in a semiautomated information system, "negotiating" retrieval specifications through conversational man-computer interaction; cost of storing the contents of the Berkeley library in computer-processible form; an experimental on-line information network for universities.

J. C. R. LICKLIDER,
Program Arranger

Society of Technical Writers and Publishers (T2)

During a panel discussion, "Strengthening the scientist's communicative skills" (30 December 1965), H. C. McDaniel (Westinghouse Electric Corporation, Pittsburgh) noted that the course this country will pursue for the next few years will be determined largely by the rate of technological advancement, and that the private citizen must be kept informed so that he can make intelligent decisions. Scientists possess at least two vocabularies—the common English vocabulary, and the specialized technical and scientific vocabulary. In communicating research results, the audience determines word choice. It is not enough to use only words the reader can understand; these must also be words he cannot misunderstand. Manuscripts should be free of bias, particularly if this relates to conclusions. The more objective the analysis, the more useful the results.

In examining "the valued decision" within the framework of today's complex society, Harold Hornby (Ames Laboratory, National Aeronautics and Space Administrations, Sunnyvale) analyzed factors such as criteria for value judgments, evaluation of alternative approaches, mechanisms for assuring objectivity, and today's planning vis-à-vis tomorrow's anticipated requirements. It was shown how these criteria relate to the universality of science and to the strengthening of the concept of total education.

Improved methods of scientific reporting were considered by Carl M. Johnson (U.S. Navy Electronics Laboratory, San Diego). Noting that much time, effort, and money have gone into the retrieval of scientific literature, Johnson suggested that at least equally important should be improvement of the material being retrieved, so that it can be quickly comprehended by the read-

er and readily found in the document center. The QRC (quick reader comprehension) reporting technique was cited as an example of an effective information retrieval method now being used successfully at the Navy Electronics Laboratory and elsewhere.

Supervision as the key to effective communication was discussed by James W. Souther (University of Washington, Seattle). It was pointed out that the supervisor—the university professor guiding the work of graduate students, or the scientist-supervisor in industry or government directing the work of scientists—exerts a powerful influence on scientific writing. No longer can we afford supervisors who do not meet their responsibilities with respect to strengthening the communicative skills of those who work for them. If science supervisors are to exert a positive influence, they must understand the kinds of problems science writers must solve, must identify the informational needs and the reading habits of the anticipated audience, and must establish procedures for effectively directing the writing of scientists.

The panel was cosponsored by AAAS (Section T) and the Society of Technical Writers and Publishers. Gunther Marx (IIT Research Institute, Chicago) arranged the session and presided at the meeting.

GUNTHER MARX,
Program Chairman

Statistics (U)

Section U sponsored or cosponsored 28 sessions at the 1965 AAAS meetings in Berkeley. The largest group of meetings (18) were the December sessions of the Fifth Berkeley Symposium on Mathematical Statistics and Probability.

The address at the vice-presidential session was given by Oscar Kempthorne on "The classical problem of inference —goodness of fit." Arrangements for this address were made after it was learned that Dr. Fry would not be able to attend. Neyman, first chairman of Section U and organizer of the Berkeley Symposium, presided.

The 18 sessions of the Berkeley symposium included 65 papers on subjects such as weather modification, information processing and cognition, medical diagnosis by computer, astronomy, demography, genetics, and other topics. The earlier meetings of the Berkeley Symposium were held in June and additional sessions were held in January

1966. The papers will be published by the University of California; papers on weather modification and discussions will form a separate volume.

A major problem in the epidemiology of mental disorder is that no single set of statistics can be taken as truly representing either incidence or prevalence. At a session arranged for the Population Association by Everett Lee (University of Pennsylvania) results obtained from various sources were critically examined. Enough agreement as to some of the most important differentials appears to establish important elements in this area.

A session, "Experiments on operating information systems," arranged by Ezra Glaser (National Institute of Health) discussed the actual problems encountered at the Patent Office and elsewhere in developing search systems and other information procedures.

Other sessions cosponsored by Section U included the symposium on Measuring Quality in Education (with Section Q and others), Computers and Universities (with Section P and others), a session on Statistical Methods of Bioassay arranged for the Biometric Society (ENAR) by Douglas Robson (Cornell) and two sessions arranged by the Biometric Society (WNAR). The Section also cosponsored the two sessions arranged by the Society of Systematic Zoology on "Biological data retrieval and computer analysis."

MORRIS ULLMAN,
Secretary

Biometric Society, Eastern North American Region (U3)

The session on bioassay placed emphasis on the use of prior information in the statistical design and analysis of routine assays. Variances among previous slope and intercept estimates for the Standard Preparation provided the basis for deciding the number of doses of Standard and Test Preparations to include in a parallel-line assay. A numerical illustration comparing variances of potency estimates based on a single dose of Test Preparation and 0, 1, or 2 doses of a Standard antibiotic showed that for a fixed total number of observations the 1-point assay, using prior estimates of both slope and intercept for the Standard, was less accurate than the 2- and 3-point assays. The problem of nonparallelism between Standard and Test dosage-response curves was examined and formulas were presented for confidence interval estimates of dose-specific potency values. In quantral response assays where the probit slope $(1/\sigma)$ is known a priori, the LD_{50} can be estimated homoscedastically by an "up and down method" in which animals are tested singly in sequence at dose levels which change by $c\sigma$ units in each trial. If an animal does not respond then the dose is increased for the next animal—otherwise the dose is decreased. The experiment is terminated after a fixed number of trials following the first change in direction of dosage increment. The LD_{50} is then estimated by the maximum likelihood method. For $c = 1$, errors of $\pm 2\sigma/3$ in setting the dose increment value were shown to have a negligible effect with respect to variance and bias of the LD_{50} estimate.

D. S. ROBSON,
Program Chairman

Science in General (X)

Sigma Delta Epsilon (X3)

A luncheon for all women in science was held in the Women's Faculty Club of the University of California in Berkeley on 28 December 1965. Mary L. Willard (Pennsylvania State University; past president and national honorary member of Sigma Delta Epsilon) was the speaker. She gave a very interesting talk on criminalistics and called on members of the audience to act as visual aids to illustrate her stories.

The annual dinner and Grand Chapter meeting was held on 29 December 1965. National honorary membership was conferred on four members of the Fraternity; Helen Dyer and Mary E. Maver, in absentia; Mary Rogick, posthumously; and Anna Rachel Whiting, in person. Whiting, at present a consultant to the Oak Ridge National Laboratories, Biology Division, gave a brief talk on her studies on the genetics of *Habrobracon* wasps through the use of x-ray irradiation at various stages of the wasps' development. She plans now to study the effect of weightlessness on the genetics of this species by sending wasps into space on a Gemini flight.

Eleanor Alexander Jackson, one of the recipients of the 1965 grants-in-aid, reported on her attempts to cultivate *M. leprae* on media used for the growth of *M. tuberculosis*. She has been able to grow the organism from freshly excised leproma nodules sent to her from Brazil and to produce lepromalike lesions with them in newborn rats.

At the business meeting money was appropriated for three additional grants-in-aid for 1966, a check for $200 was contributed to UNESCO to help finance science education in Nigeria, and the Miles College project was extended for the new fiscal year. Amendments to the constitution and bylaws were adopted to implement the change in fiscal year. The possibility of creating a new office, that of business manager for the fraternity was discussed and the present treasurer appointed to fill the office until it can be properly established at the next meeting of the Grand Chapter. Finally, national officers were elected and installed to take office 1 July 1966, the beginning of the new fiscal year, present officers will function until 30 June 1966.

HARRIET M. BOYD,
National Secretary