Physical Science

Following are reports on some of the physical science sessions to be held at the Berkeley meeting. Others are described in the November issue of the *AAAS Bulletin*. The entire program will be published in the 4 December issue of *Science*.

Moving Frontiers

One in the "Moving Frontiers of Science" series of invited lectures will be presented 28 December by William Fairbank (Stanford University). Discussing aspects of low-temperature physics, he will point out the importance of "zero" in several basic approaches to physics investigation. He will consider how the very foundations of physics can be explored in a new way by reducing "nearly to zero" one of the fundamental variables—which include temperature, magnetic field, electrical field, and gravitation field. For example, the properties of matter close to the absolute zero of temperature, in addition to being themselves of basic interest, are now providing the opportunity for study of fundamental questions on gravitation, relativity, and elementary particles.

Physics

Berkeley is world known for its big accelerators and the research being done with them. Most of the fundamental studies of the Lawrence Radiation Laboratory are conducted in a sprawling complex on Charter Hill overlooking the campus. On "The Hill" today is a battery of four diverse operating accelerators: the 184-inch cyclotron, where man-made mesons were created in 1948 (marking the beginning of the modern era of high-energy physics in the laboratory); the 6.2 Bev Bevatron, which gave birth to the antiproton and the antineutron and launched the present "population explosion" of particles; the HILAC (heavy ion linear accelerator), used to discover elements 102 and 103; and the new 88-inch sector-focusing cyclotron, bringing new precision to low-energy physics and helping to revolutionize nuclear chemistry. With its associated laboratories (including the Donner Laboratory of Medical Physics, Laboratory of Chemical Biodynamics, and Inorganic Materials Laboratory), the AEC-supported Lawrence Radiation Laboratory is the prototype of the big interdisciplinary laboratory fully integrated into the teaching and research program of a large campus.

The program for the AAAS section on physics will feature addresses by two Nobel laureates prominently associated with accelerator research during the last three decades. Emilio Segré (University of California, Berkeley) will present the Section B vice-presidential address (27 December) on "Physics in the Last Twenty Years." Few living physicists are better qualified to discuss this subject. Segré was a colleague of Fermi in Rome. Using an activated bit of a Berkeley cyclotron deflector plate, he and Perrier discovered the first synthetic element, technetium, in 1937. In 1955 he and Chamberlain discovered the antiproton in a Bevatron experiment, and the more recent interests of these two scientists have involved polarized nucleons.

Segré will discuss the great growth of physics as a part of the growth of science generally during the post-war period. He will point out that not only did the political powers and the public recognize, as a result of wartime developments, the potential of applications of science, but that scientists themselves also learned the power of large-scale operations with which they were unfamiliar before the war.

Great strides have been made during this period of physics, Segré believes, although they do not yet equal that most striking period in the history of modern physics, 1895 to 1925, when quantum mechanics and relativity were elaborated. Segré considers the most important fundamental achievement in theory of the post-war era to be the discovery of the non-conservation of parity. In the experimental field, the physics of particles has been outstanding. Segré will also discuss other fields of physics: low energy, solid state, atomic, and the application of computers.

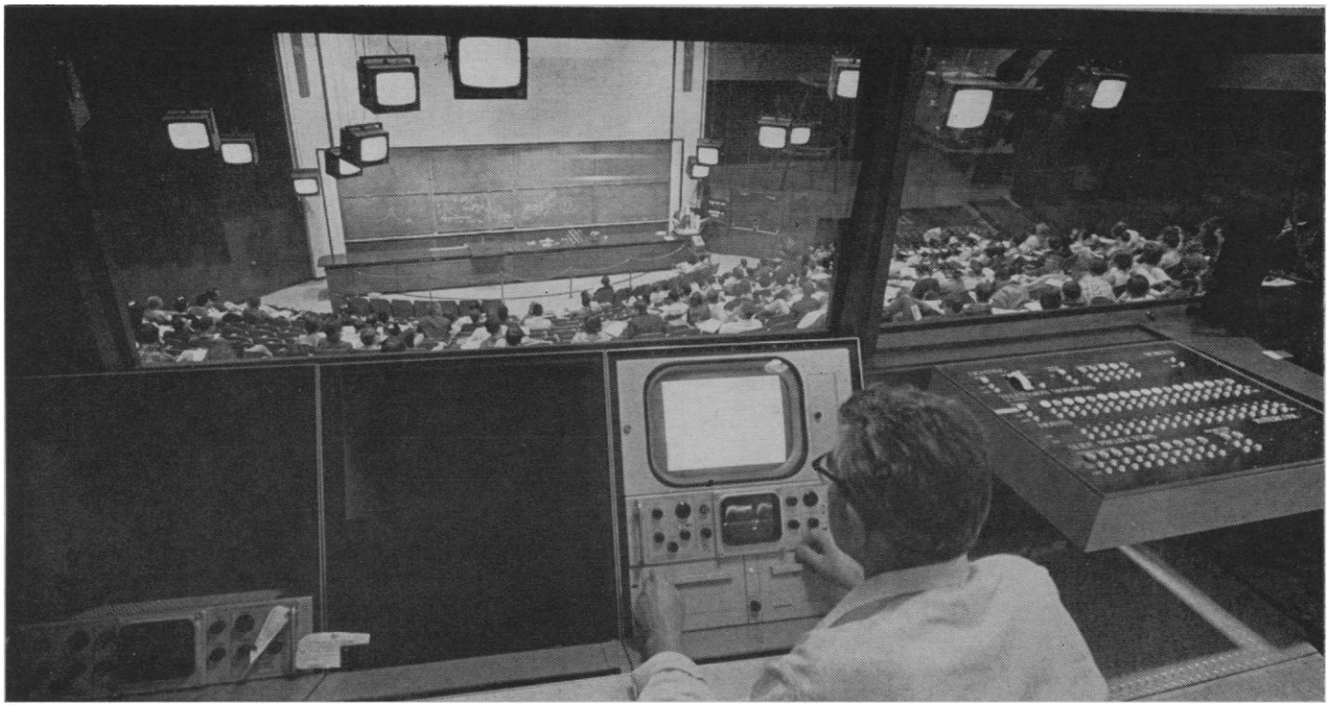
At a session on teaching and research in physics (27 December), Edwin M. McMillan (University of California, Berkeley) will discuss "Current Problems in Particle Physics." Serving now as director of the Lawrence Radiation Laboratory, McMillan has been identified with the work at Berkeley since 1934 and with the upward march of accelerator energy. McMillan and V. Veksler of Russia independently authored the theory of phase stability toward the end of World War II, a theory that permitted achievement of the high energies in accelerators during the post-war period. A group in his laboratory has been conducting (for the AEC) the design study for an accelerator in the next (200 Bev) energy range.

Chemistry

Vigorous work along the borders that divide (but do not separate) the disciplines of chemistry and biology has, in large part, provided the basis for a predicted "era of biology" in the second half of the 20th century. Here the investigator approaches the fundamentals of life itself.

A two-part symposium on "Proteins and Nucleic Acids" has been arranged by Nobel laureate Wendall M. Stanley (University of California, Berkeley), who isolated and characterized the tobacco mosaic virus nearly three decades ago. The diversity of current approaches and disciplines is illustrated in the topics of invited papers. In the first session (27 December) George Stark (Stanford University) will discuss techniques in studying the primary structure of proteins; Daniel Koshland (University of California, Berkeley), relations of structure to function in enzyme action; Ignacio Tinoco, Jr. (University of California, Berkeley), structures and optical properties of ribonucleic acids; and Philip Hanawalt (Stanford University), repair replication of damaged nucleic acids *in vivo*.

In the second session (28 December), David Hogness (Stanford University) will discuss structure and function of the DNA from bacteriophage



From its control room, one can view all of Berkeley's radical new physical sciences lecture hall. Its closed-circuit TV brings experiments and teaching material "close-up" for students in large classes. And its rotating circular stage, split into three pie-shaped pieces, maximizes usefulness of the hall by permitting demonstrations on one-third, while setup and knockdown are simultaneously underway backstage. The hall will be demonstrated by Berkeley physicist Harvey White during his talk on "The Lawrence Hall of Science," to be given 27 and 29 December. [Public Information, University of California]

lambda; John Gerhart (University of California, Berkeley), subunit structures of proteins and their importance for control processes; Hugh Fudenberg (University of California, San Francisco and Berkeley), biological and biochemical aspects of hereditary human gamma globulin groups; and Allan Wilson (University of California, Berkeley), evolutionary and taxonomic studies with enzymes.

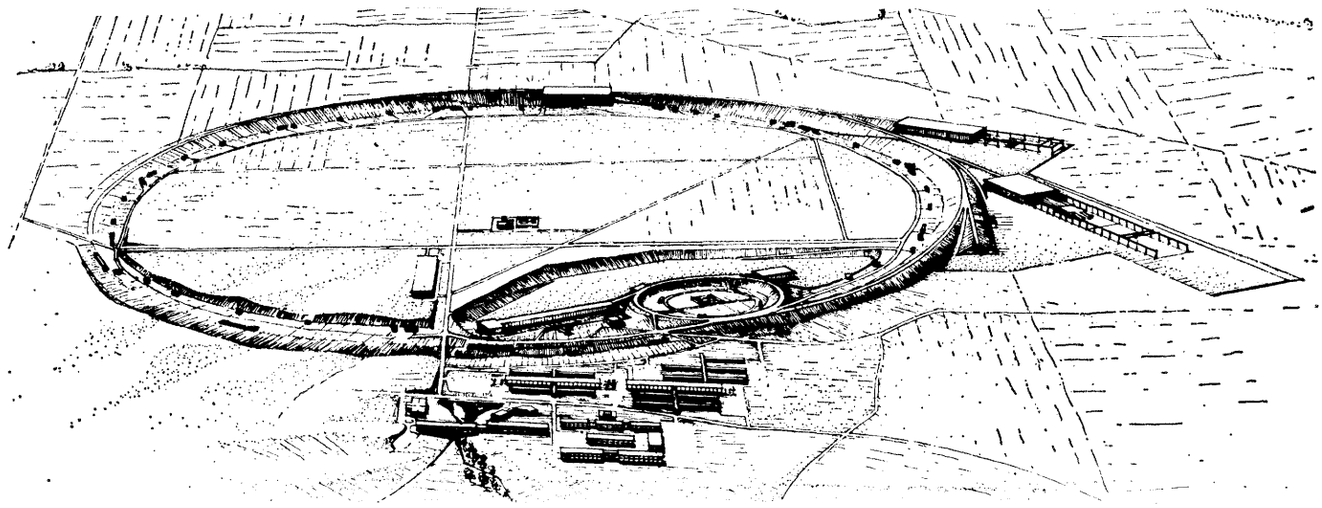
On another frontier of chemistry that is marked with current excitement, a symposium has been arranged for 29 December by George C. Pimentel (University of California, Berkeley), and Harmon W. Brown (Varian Associates) on the subject "Recent Developments in Energy Transfer." While chemists of former decades took the macroscopic view to learn the thermodynamics of reactions, today's chemist is often unwilling to limit his knowledge to an average level of energy distribution. Needed now is a detailed understanding of the dynamics of chemical reactions on the molecular level. What happens to energy when just two molecular fragments join or split? What are the degrees of freedom in single molecules, and how does energy pass from one degree of freedom to another or from one molecule to another? When is energy transfer shown in translation, vibration, or rotation? The symposium will illustrate the wide variety of techniques (from both chemistry and physics) that are now yielding interesting success in phases of the problem.

From the point of view of intramolecular energy transfer, M. A. El-Sayed (University of California, Los Angeles) and Glenn A. Crosby (University of New Mexico) will present papers based on electronic spectroscopy. Reports from Herbert P. Broida (University of California, Santa Barbara) and William L. Klemperer (Harvard University) will deal with intermolecular energy transfer in the gas phase, with particular emphasis on vibrational and rotational energy transfer. Findings based upon electron spin resonance techniques to study intermolecular energy transfer in the condensed phase (including biological systems) will form the subjects for papers by Ellen Weaver (Stanford University), John Q. Adams (Chevron Research Co.), and Harden McConnell (Stanford University). G. Wilse Robinson (California Institute of Technology) will discuss transfer in the condensed phase from experiments utilizing electronic spectroscopy.

A third chemistry symposium, arranged by Harry S. Mosher (Stanford University) for 27 December, will deal with three of the most potent nonprotein neurotoxins known to occur in nature. Henry Rapoport (University of California, Berkeley) will report on studies of saxitoxin, which is associated with the "red tides" of plankton that occur periodically throughout the world and kill millions of fish that eat them. The unexplained "red blooms" of these poisonous, one-celled organisms are a serious problem in many coastal waters because of the key role such organisms play in the food chain of the oceans. While some shellfish can survive ingestion of these creatures, they concentrate the toxins and become poisonous to humans. This has given rise to the warnings against eating shellfish in the "R" months.

The chemical structure of a similar poison, ciguatera, will be discussed by Paul Scheuer (University of Hawaii). One of the most elusive of the nonprotein toxins, ciguatera constitutes a public health problem in the Pacific islands, where it can cause certain fish to become poisonous to humans. The origin of the toxin is not known.

Batrachotoxin, subject of a report by John Daly (National Institute of Arthritis and Metabolic Diseases), comes from the skin of a colorful South American frog. The most toxic



Artist's view of a proposed 200-Bev accelerator, based upon design studies conducted for the U.S. Atomic Energy Commission by the University of California's Lawrence Radiation Laboratory, Berkeley. Higher energies achieved by such a machine (which is approximately 1 mile in diameter) can provide powerful tools for investigation in the field of particle physics. [Lawrence Radiation Laboratory]

of all, it is also known as "Kokoi venum," and is used by Colombian Indians to poison their arrowheads. The symposium will center on the chemistry of the three neurotoxins, with some discussion of their pharmacological aspects.

Astronomy

Four hundred years after Galileo, observational astronomy still holds exciting promise. A case in point is the landmark work of Horace W. Babcock, who in 1945 placed a differential circular analyzer before the slit of a high-dispersion spectrograph and thereby (via the longitudinal Zeeman effect) found the first substantial evidence for stellar magnetism. By comparing stellar spectra in left- and right-hand polarized light, astronomers can ow detect displacement in stellar absorption lines indicating the presence of a net longitudinal magnetic field. In more than 15 years of work Babcock found some 90 stars that show evidence of magnetic fields ranging in strength from a few hundred to several thousand gauss. Most are so-called peculiar A stars (A_p) that lie on or near the main sequence, have surface temperatures of the order of 10,000°K, and are characterized by large overabundances (compared to the sun) of certain elements, notably the rare earths. Babcock also found evidence for magnetic fields in a number of other kinds of stars—including several metallic-line stars, one RR Lyrae star (RR Lyrae itself), one "subdwarf," and two long-period variables.

No constant stellar magnetic field has yet been noted. Babcock found that the peculiar A stars could be divided into alpha-variables (periodic field variations with periods of 5 to 10 days), beta-variables (irregular field variations with reversing polarity) and gamma-variables (irregular field variations with constant polarity.) He also found that the magnetic periods of alpha-variables are identical to the periods of "spectrum variations" (variations in intensity of certain spectrum lines) in the same stars.

As a model for these stars, Babcock suggested that field variations are due to hydromagnetic fluctuations or oscillations that may lead to irregular or periodic surface field variations. Armin J. Deutsch, on the other hand, proposed an oblique-rotator model based upon the premise that an axisymmetric (usually dipole for simplicity) general magnetic field is inclined to the axis of rotation of the star, that certain atomic species (those that undergo spectrum variations) are concentrated in "patches" on the surface of the star, and that the observed line-intensity and magnetic field variations are aspect effects due to changes in the properties of the surface that faces the observer as the star rotates.

In the 1965 Warner Price Lecture (29 December) of the American Astronomical Society, George W. Preston (University of California, Lick Observatory) will discuss "Studies in Stellar Magnetism—Past, Present, and Future." Preston points out that the pioneer work of Babcock presents a bewildering array of problems to the investigator. As examples, he cites the need for extended survey work on A_p stars to achieve a statistical test of the oblique rotator model, questions that stem from discovery of a very large magnetic field (34 kilogauss in HD 215441—an "ordinary" silicon star), problems of special magnetic effects and a supposed differential motion of regions of opposite magnetic polarity, and the puzzling possibility that magnetic variations are related to pulsation properties in stars.

Preston's investigations on stellar magnetism currently utilize analyzers that have been placed in operation at the coudé spectrograph of the 120-inch reflector at Lick Observatory. In one approach, the study is centered on the "crossover effect" indicating a tendency toward reversing polarity and the possibility (in the case of 78 Virginis—the first magnetic star discovered) that the surface of the star might be covered with magnetic domains in which radial motions are correlated with field polarity. Other approaches look toward obtaining evidence on the validity of the oblique rotator model, on the possibility that general magnetic fields of G-type dwarf stars might be age dependent, and on the proposed interpretation (by Endre Balazs) of light and velocity modulation of RR Lyrae (explaining the star as at

once an eruptive variable and an oblique rotator). In his lecture, Preston will also consider some of the Zeeman observations planned for the future.

Geology and Geography

The students of Carl O. Sauer, now retired as professor of geography at the Berkeley campus, form a strong and distinct group in American geography.

John Leighly offers this distillation of Sauer's teaching: "There is such a thing as a humane use of the earth; the simpler cultures are less destructive of the terrestrial basis of man's existence than is our present technology; and the possessors of modern technology may find in the past experiences of man on the earth guidance toward a balance of the capacities of the land with the requirements of life that gives some promise of permanence."

In recognition of his leadership and influence, eight former students will present "Papers in Cultural Geography in Honor of Carl O. Sauer" at a symposium arranged by Marvin W. Mikesell (University of Chicago).

Math/New Math/Computers

Sounding a keynote for a full series of programs on mathematics and computers, Bernard Friedman (Berkeley) will present the AAAS mathematics-section vice presidential address on 27 December, on "The Direction of Mathematics Development in Relation to the Other Sciences." He will point out that the trend in present-day mathematics is to study more and more abstract structures that have little relation to reality or to possible application to the natural or social sciences. On the basis of past experience, however, he sees a reasonable expectation that these abstract structures someday will prove useful "in the study of the world around us."

A symposium on "The New Mathematics" has been arranged for 27 December by Wallace Givens (Argonne National Laboratory and Northwestern University). It will center on developing programs in mathematics education in the elementary and high schools, and particularly how the programs can be modified to be more useful to scientists and other users. The need for advice from scientists in other disciplines will also be emphasized.

A panel will consider the work of the School Mathematics Study Group (SMSG), with papers by Edward G. Begle (Stanford University) on "The Role of Mathematics in the SMSG Program," William Sandmann (Harvey Mudd College) on "Science in the Junior High School Mathematics Curriculum," Victor Twersky (Sylvania Electronics Defense Laboratories) on "SMSG and Mathematical Physics," and Elliot I. Organick (University of Houston) on "Principles of Computer Science in the High School Mathematics Curriculum." Additional speakers in the "new math" symposium will include Paul C. Rosenblum (Columbia University) on "Coordination of Mathematics and Science" and Max Bieberman (University of Illinois) on "What is Important about the 'New Mathematics'?"

Recent advances in computer technology and application will form the themes for two symposia. One (29 December) will consider new developments for the use of computers in scientific computation, with particular emphasis on on-line systems. Arrangements here are by Harry D. Huskey (University of California, Berkeley), who points out that low-cost terminals on a large computing system can permit the completion of computational problems (or the real-time monitoring of actual experiments) to achieve costs that compare favorably with those of batch processing under older computing systems. He notes that a significant advantage can be gained in time saving, with a problem completed in one sitting (perhaps in about an hour) instead of the several passes required in a batch-processing system (with each pass requiring several hours).

Invited papers will be presented by Frank Marzocco (Michigan State University) on recent developments in pattern recognition and David Evans (University of California, Berkeley) on a description of on-line computing systems. In a demonstration of on-line application, John W. Brackett (Massachusetts Institute of Technology) will show the use of the Project MAC Computer at MIT and will illustrate the use of a new language called MAP (designed for mathematical analysis). A second demonstration presented by Huskey will feature the time-sharing computer of Project Genie ("the helpful research tool") at Berkeley, with particular emphasis on a reactive scheduling program.

The second symposium arranged for 30 December by Anthony G. Oettinger (Harvard University), will present recent views on applications of computers to natural language processing. Gerard Salton (Cornell University) will speak on progress in automatic information retrieval, reviewing the current state-of-the-art with emphasis on automatic text processing systems. He will use the SMART automatic document retrieval system to illustrate some of the techniques and present capabilities. David G. Hays (RAND Corporation), in a paper entitled "Publish (Rationally) or Perish," will discuss methods for processing text as an array of letter images, which are ready now for application in the publishing industry. In his view, theoretical and empirical studies of language as a system with syntactic and semantic structure are beginning to show how the traditional concepts of publication can be profoundly revised. Robert F. Simmons (Systems Development Corporation), discussing "Answering English Questions by Computer," will outline some current lines of research in question answering and will show sample responses. William H. Bossert (Harvard University), speaking on the evolution of animal languages, will advance the view that the relationship of language to survival is well enough understood for a number of types of animal languages to permit their evolution to be predicted from an initial state. He will demonstrate computer simulations of the evolution of several such languages.

Computerized Universities?

Computers have been maligned as symbols of the "inhuman" aspects of large universities. Yet the printed book was once held in similar ill esteem, as one college administrator pointed out recently. Computers in fact hold great promise for revolutionary improvements in higher education. They can enhance the teaching process, streamline administrative procedures, make libraries more useful, link the entire nation in information networks, and even free the professor from routine tasks so that he can spend more "human" time with his students.

The University of California's new

campus at Irvine, enrolling its first 1,500 students this year, will be developed as a unique laboratory for computer applications in higher education. With a planned enrollment increase of 1,000 students per year, the campus recognizes the computer as a "must" in administrative operations and as an integral aid to education and research. Programmed instruction, computer-television systems, even a kind of "total instant knowledge" may be available on tomorrow's computerized campuses.

Physiologist Ralph W. Gerard (University of California, Irvine) has arranged a symposium which will examine both present applications and future prospects for "Computers and Universities" (29 December).

RAY COLVIG

Office of Public Information,
University of California, Berkeley

The report on the symposium to be held at Berkeley on "Remote Sensing of Environment" (22 October, page 510) omitted mention of two of the six speakers. John R. Place of the Office of Naval Research will report on trends in ONR funding of research in remote sensing; ONR has sponsored the three national conferences on the topic at the University of Michigan, and a fourth will be held there next April. James P. Lathan, Florida Atlantic University, arranged the symposium. He will report on his research aimed at automating the overpowering job of identifying meaningful patterns in images (perhaps at more than one frequency) of the earth, taken from such platforms as airplanes and satellites.

Amendments to AAAS Constitution

The Board of Directors and the Committee on Council Affairs recommend that the following amendments be made in the Association's constitution. The constitution specifies: "Proposed amendments shall be published officially in substance at least one month prior to an annual meeting of the Association. A proposed amendment that is approved by the Board of Directors shall require for its adoption a favorable vote of two-thirds of the Council members present in a Council session of that meeting."

Article III, *Section 1.* Amend by deleting the material enclosed in brackets and adding the italicized material: "The officers of the Association shall be (a) general officers [elected from among the Fellows by ballot of the Council,] and (b) administrative officers [elected by the Board of Directors as prescribed in Section 3 of this Article]. *Of the general officers, the president-elect and members of the Board of Directors shall be elected from among the Fellows by ballot of the Fellows, and a vice president or vice president-elect (as each section committee may individually determine) for each section shall be elected from among the Fellows by ballot of the Council. Administrative officers shall be elected by the Board of Directors as prescribed in Section 3 of this article.*"

Article III, *Section 2. General Officers.* Amend by adding the italicized material: "The general officers of the Association shall be the elected members of the Board of Directors, a president-elect, a president, a retiring president, and a vice president for each section. The term of office of the president-elect and of the vice presidents shall be one year and shall begin on the January 15 following their election. At the close of the one-year term of the president-elect he shall become president, and at the close of the one-year term of the president he shall become retiring president. In the event of a vacancy in the office of the president, the president-elect shall become president. In the event of a vacancy in the office of president-elect, the Board of Directors shall make a pro tempore appointment to hold until the vacancy shall have been filled by ballot of the Council. *In the event of a vacancy in the office of vice president for a section that has a vice president-elect, the vice president-elect shall become vice president. In the event of a vacancy in the office of vice president for a section that does not have a vice president-elect, the Board of Directors shall make an appointment to fill the vacancy.*

Article IV, *Section 2.* Amend by deleting the material in brackets and adding the italicized material: "The Council shall consist of (a) the president-elect, the president, the retiring president, all past presidents, the vice presidents, the secretaries of the sections, *the members-at-large of the section committees,* the executive officer, the treasurer, and the eight (8) elected members of the Board of Directors; (b) [one] *two* Fellows elected by each regional division of the Association; and (c) the representatives of affiliated organizations as provided in Article VIII of this constitution. Each Council member shall serve until his successor shall have taken office. Each Council member shall have one vote. The president shall be chairman of the Council; if the president is unable to serve as chairman at any session, the president-elect shall serve in his stead; if neither is able to serve, the Council members in attendance shall elect a chairman for that session. Thirty (30) members of the Council shall constitute a quorum for the transaction of business."

Council will vote on these amendments at the annual meeting, in Berkeley, California, on 30 December 1965.

DAEL WOLFLE