"The Intelligent Man's Guide" to the 1967 AAAS Meeting

Walter G. Berl, *Meeting Editor*

It will no longer do for scientists to convince each other of the importance of what they are doing and ask the tax payer to take it on faith.—DONALD F. HORNIG

Like many cultural institutions with a long history, the AAAS Meeting carries within its structure and as its objectives remnants of the past and seeds of the future. It is a mixture of the old, happily remembered and of the new, as yet untried. It brings with it some untidiness in organization which even loyal followers find difficult to understand. However, it permits flexibility and freedom to experiment. It is, therefore, full of promise.

My purpose is to introduce the reader briefly on how the pieces of this year's AAAS Meeting fit together and to persuade him that he would find much pleasure in attending, no matter whether he comes as a representative of the Lay Public, as an Apprentice, a Research Man, Teacher, Administrator, Reporter, or Critic.

First, a statistical bird's-eye view. About 1200 persons will give lectures, participate in panel discussions, contribute to more than 100 symposia and specialized sessions. There will be discussions of national problems (Crime, Science and Technology; Man and Transportation; Marine Science; Defense Against Ballistic Missiles; Political Decision Making; Delivery of Health Services). There will be discussions of many specific subjects (among them Extraterrestrial Life, Evolution of the Earth's Atmosphere; Animal Communications; Web-Building Spiders; Psychochemical Research Strategies in Man; Molecular Approaches to Learning and Memory; Adhesion in Biological Systems; Measuring Group Achievement in Education; The Role of Museums in Communications).

To fit this material into a manageable framework it is arranged in three distinct patterns. Most of the specialized topics originate either with the 20 AAAS Sections (ranging from Astronomy to Zoology) or with Affiliated Societies joining in with the AAAS Meeting. Topics and participants are chosen according to the individual best judgments and needs of these groups. Clearly, no uniformity in approach and style can be expected (or even wished for). The result, as shown in the summaries of symposia beginning on page 1347 (and in greater detail in the Meeting Program) is a coverage of scientific and technical problems in breadth and, often, in depth.

Added to this extensive program are a much smaller number of symposia and discussions of such a nature that their assignment into the sectional framework is either unwire or unworkable. These "General Symposia" are organized by AAAS Committees with specific responsibilities or originate spontaneously elsewhere. Many address themselves to questions of the broadest significance and relevance. This year's choices (summarized on pages 1345 to 1347) illuminate some achievements and unresolved problems facing our nation and the world.

A substantial number of Invited Lectures on a variety of subjects, given by some of the most thoughtful people in this country and abroad, are scattered through the 5 days of the AAAS Meeting (listed on pages 1343 and 1344). They are aimed, together with several panel discussions, at the lay public which expects to be instructed skillfully about important questions posed or answered by science and technology.

In addition to the lectures and discussions the AAAS Meeting, for the first time after a long pause, offers to registrants several Tours and Open Houses (Rockefeller University, New York Botanical Garden, New York Zoological Park, Boyce-Thompson Institute for Plant Research, Haskins Laboratory, Lamont Geological Laboratory of Columbia University, and the Aquarium of the New York Zoological Society). Senior members will review phases of work under way and lead visits to the laboratories.

Several exhibits and special lectures are planned. For instance, at the Rockefeller University, in conjunction with the symposium on "Michael Faraday—Natural Philosopher" and a lecture demonstration by Ronald King of the Royal Institution (London) an exhibit will commemorate the centennial of the death of Michael Faraday. The John Pierpont Morgan Library, the New York Public Library, and the New York Botanical Garden will show special displays from their extensive collections. The Sierra Club, IBM Galleries, New York Historical Society, and American Museum of Natural History will invite registrants to visit their current exhibits. Lastly, the AAAS Science Film Theatre will show many award-winning films from the recent XXIst International Science Film Festival, the complete series of "Lewis Mumford on the City" and film-illustrated lectures by Gerald Holton (Harvard) on "People and Particles," by Walter A. Starck II (University of Miami) on "A Fish-Eye View of Alligator Reef," and by Peter Morris (Canadian Film Institute) on "Seventy-five Years of Scientific Films: 1890–1965" (see pages 1366 and 1367).

In summary, then, the technical program ranges from subjects of broad and general interest to a large number of more specialized topics. The "mix" that any one participant will select for himself depends on his particular interests and resiliency. The specialized sessions should give pleasure to those who have a direct professional interest in them. The objectives of the AAAS Meeting would *not* be served, however, if participation at such sessions were the only reason for attending for, then, the hundreds of meetings of professional societies would serve as well or better. Rather, the AAAS Meeting, in its variety, offers opportunities to people who do not want to be restrained by rigid and artificial boundaries on their outlook and who wish to observe and participate in the much wider purpose of the AAAS. One is intelligent "cross-linking" among the professionals. The other is to give the public (and the individual professional) an opportunity to take part in the discussions, to discover connections, to ponder causes, and to glimpse a bit of the future.

The following pages list, in summary fashion, the lectures and symposia to be given at the 1967 AAAS Meeting. In previous and subsequent issues of Science, *some of them are described in more detail, as are the research interests of institutions where tours are offered.*

AAAS INVITED LECTURES

Frontiers of Science: Lecture I

26 December, evening.

Speaker: Carroll M. Williams (Bussey Professor of Biology, Harvard University).

Hormones, Genes, and Metamorphosis.

One of the larger and more intractable mysteries of present-day biology is epitomized by the transformation of an egg into a full-fledged organism. What we witness is an orderly enlargement and diversification of the cellular community according to an individual-specific construction manual which the fertilized egg inherited from the previous generation. By analogy to microbial systems, differential gene repression and derepression are central to all present theories of cytodifferentiation. Moreover, we can state with assurance that the orderly diversification of the community of cells is under close-up as well as overall chemical control.

Particularly illuminating are recent investigations of the metamorphosis of insects. Insects that metamorphose are especially interesting subjects because in them the formative processes continue long into the postembryonic period instead of being restricted to the period of embryonic development, as in most other animals.

The cellular events which comprise metamorphosis are tightly coupled to endocrine signals administered by two hormones—ecdysone and juvenile hormone—both of which have recently been identified and synthesized. Present indications are that, by an apparently indirect mechanism, these hormones play upon the chromosomes to control the flow of genetic information and its implementation by the synthetic centers of the cells.

Frontiers of Science: Lecture II

27 December, afternoon.

Speaker: Dame Kathleen Lonsdale, F.R.S. (Professor of Crystallography, University College, London, W.C.1; President, British Association for the Advancement of Science).

Some Studies of Human Stones.

A general review is given of the occurrence of urinary calculi from historical and geographical standpoints, taking into consideration location, composition, and age distribution. Some kinds of stones are dying out in some localities, others are on the increase, especially for certain groups of people. The various methods of determining composition are reviewed and comparative data given. The formation of a nucleus can be related to various causes of crystal growth and the reasons for subsequent development of the stone are considered, especially where the composition of the stone changes from time to time. Collections of nearly 1000 bladder and kidney stones mainly from Britain (going back to 1770), India, Indonesia, Spain, Thailand, and Turkey have been examined by x-ray diffraction techniques. The results of these and other investigations are compared graphically, to see whether any conclusions can be drawn about the possible causes of stones, including the possibility of kidney stone formation as an occupational hazard. Results of a few interesting studies of gallstones are also given.

Frontiers of Science: Lecture III

28 December, afternoon.

Speaker: Roger Revelle (Center for Population Studies, Harvard University).

Can the Poor Countries Benefit from the Scientific Revolution?

Panel Discussion. Athelstan Spilhaus, *Chairman.*

E. A. Mason (Massachusetts Institute of Technology).

William Paddock (Consultant in Tropical Agricultural Development, Washington, D.C.).

Hans W. Singer (United Nations Industrial Development Organization).

Distinguished Lecture

27 December, evening.

Speaker: Athelstan Spilhaus (President, Franklin Institute, Philadelphia).

The Experimental City.

George Sarton Memorial Lecture

28 December, afternoon.

Speaker: Cyril Stanley Smith (Institute Professor, Massachusetts Institute of Technology).

The Revival of Qualities, Corpuscles, and Phlogiston in the Modern Science of Materials.

Views on the nature of materials will be traced from workshop discoveries, through the forms and elemental qualities of Greek philosophers, Paracelsian principles, Cartesian corpuscles, and phlogiston to the rigid molecular chemistry of the nineteenth century. Some of each of the old views seems to have been revived in today's emphasis on properties based on the behavior of electrons within complex structures.

Address of the Retiring President

28 December, evening.

Speaker: Alfred Sherwood Romer (Alexander Agassiz Professor Emeritus of Zoology, Harvard University).

Major Steps in Vertebrate Evolution.

Special Lecture

29 December, morning and afternoon.

Speaker: Herman Kahn (Director, Hudson Institute).

Speculations on the Next Thirty-three Years.

Among the important respects in which industrial society differs from all the societies that went before are the unprecedented degree of affluence, the extraordinary development of technology, and the institutionalization of secular, manipulative rationality, and thus of further economic and technological development. These basic trends of Western society can be seen as part of a common, complex trend of interacting elements—most of which can be traced back as far as the 12th or 11th centuries. For analytic purposes, we have separated them into 13 rubrics.

These processes of change, each facilitating the other, have become routinely—one might even say inexorably—cumulative. It is notorious that as a result the rate of change of many aspects of economic and social life has become exponential; and it is not likely that many of the changes that are in process will begin to decelerate during the next third of a century. Some of these trends present serious issues; indeed some of the problems created by our successes in achieving unprecedented kinds of economic and technological powers may even be overwhelming. An attempt will be made to present a general framework designed to facilitate speculation and discussion about both the opportunities and the dangers that seem likely to arise in the next 33 years.

Panel Discussion. Philip M. Hauser, *Chairman*

Daniel Bell (Professor of Sociology, Columbia).

Harrison Brown (Professor of Geochemistry, California Institute of Technology).

Walter Sullivan (Science Editor, The New York *Times*).

Hans H. Landsberg (Resources for the Future, Inc., Washington, D.C.).

Scientific Research Society of America (RESA) Annual Address and Procter Prize

29 December, afternoon.

Speaker: Abel Wolman (Professor of Sanitary Engineering Emeritus, Johns Hopkins University)

Environmental Pollution.

In the last five years Federal, State and regional legislation have vied with abatement in a push toward upgrading the quality of the air. In the haste toward action, it is not surprising that objective evaluation of the impact of all measures has fallen well behind desires and hopes. It is now timely and desirable to take a look at biologic, economic, scientific, technologic, and administrative consequences of the activities stressed by legislative action and public opinion. Such an orderly appraisal is obviously difficult, but at least a preliminary approach to an assessment seems about due.

Chauncey Starr, Philip H. Abelson, E. J. Cassell, John R. Goldsmith, and B. Weinstock.

General Lecture

29 December, afternoon.

Speaker: B. F. Skinner (Harvard University).

Teaching Science in High School—What Is Wrong?

Fewer and fewer students go to college planning to become scientists and of those who go, more change to other fields. Perhaps science has become harder to teach. The status and role of the scientist may have changed. But another possibility is that those concerned with the improvement of teaching have not made sufficient use of recent advances in educational technology. Classroom experience is still accepted as a major source of wisdom. Consequences will be analyzed. The teacher who tries to make his subject interesting to the beginning student, for example, may not prepare him for the kind of thing which interests the informed scientist. The teacher who encourages the student to discover science for himself may neglect to transmit what is already known. The scientific analysis of learning and teaching has been neglected in spite of the fact that scientists above all others should turn to it for help.

Sigma Xi–Phi Beta Kappa Lecture

29 December, evening.

Speaker: John A. Wheeler (Princeton University).

Our Universe: The Known and the Unknown.

The formation of new stars and the explosion of old stars and the greatest variety of events, gigantic in scale and in energy, make the universe incomparably more interesting than any fireworks display that anyone could imagine in his wildest dreams. However, in all this wealth of events not one single effect has been discovered which has led to a new law of physics, and not one single finding has ever been obtained which is generally recognized to be incompatible with existing law. On the contrary, Einstein's relativity and the quantum principle and the lesser laws together predict astonishing events—some of them like the expansion of the universe already observed and others on "the most-wanted list" of many present-day investigators. Among these are the "missing matter" predicted to be present by Einstein's theory and the "black holes" predicted to result from the "continued gravitational collapse" of an over-compact mass. No prediction of standard well-established theory is more revolutionary than "superspace," the dynamical arena of Einstein's general relativity, and none seems more likely to have consequences for all of physics, from elementary particle physics to the dynamics of the universe.

Illustrated Lecture of the National Geographic Society

30 December, evening.

Speaker: Bradford Washburn (Boston Museum of Science).

Mapping Mount Kennedy.

The motion picture *Mapping Mount Kennedy* covers the story of Dr. Washburn's expedition to map the St. Elias range of Canada's Yukon Territory in 1965. This expedition was sponsored by the National Geographic Society and Boston's Museum of Science, and its success was made possible by the cooperation and assistance provided by the government of Canada. Dr. Washburn also led the Society's 1935 expedition which discovered the peak named by Canada in honor of the late president John F. Kennedy in 1964. The film includes a section on this 1935 expedition as well as covering the first ascent of Mount Kennedy made in March 1965.

AAAS COMMITTEE SYMPOSIA

Norman Bauer Memorial Symposium on the Hazards of Iodine-131 Fallout in Utah (27 Dec.)

Arranged by E. W. Pfeiffer (University of Montana).

Studies now being conducted in Utah and elsewhere by the U.S. Public Health Service, the University of California, and other agencies are contributing significantly to the understanding of certain biomedical effects of radioactive fallout. It is the purpose of this symposium to bring to the scientific community and the lay public results of studies on the biomedical effects of acute and chronic exposure to radionuclides emanating from nuclear explosions and other sources of radiation.

The need for such studies was first brought to public attention in Utah in 1957 by the late Norman Bauer, Professor of Chemistry, Utah State University. This symposium is held in honor of the memory of Bauer and will emphasize the responsibility of such independent scientists to increase public understanding by providing factual information on these and other hazards which result from our advanced scientific technology.

Lytt I. Gardner, Barry Commoner, Arthur R. Tamplin, Edward Weiss, Marvin L. Rallison, Robert A. Conrad, Oliver Johnson, Martin Sonenberg, Herman T. Blumenthal, and Yook C. Ng.

Secrecy, Privacy, and Public Information (28–29 Dec.)

Arranged by Margaret Mead (American Museum of Natural History).

The first two sessions will focus on some of the complex relationships exemplified by the following questions: Is secrecy in any guise compatible with the education of students and with the practice and function of science in our society? What legal and ethical problems arise, and what actions should be considered to safeguard the individual's rights of privacy in a democracy, particularly when human beings are the subjects of research?

The third session will deal with the scientist's responsibility to bring scientific information relevant to social fields to the attention of the public. Case histories of severe air and water pollution in two American cities will be presented as illustrations of the current environmental crisis, and of interaction between scientists' information groups and the local community.

Detlev W. Bronk, Philip E. Mosley, Robert L. Sproull, Margaret Mead, Oscar Ruebhausen, Peter Rossi, Rene Dubos, Barry Commoner, David Wilson, George Berg, and C. C. Gordon.

Weather Modification in Arid Lands (30 Dec.)

Arranged by Joel E. Fletcher (Utah State University, Logan).

Man has dreamed of controlling his environment for hundreds of years. Great strides have been made through the creation of air conditioning, heating, and housing but it remained for Vincent J. Shaefer and his associates to prove that man could influence the weather. That July day in 1946 when they spread dry-ice on a cold box cloud and observed snow falling to the bottom will remain memorable in the annals of progress.

The great possibilities of weather modification almost immediately occurred to people working in arid lands. Companies offering rain for sale mushroomed. It seems inevitable to us now that a charlatan or two would be involved with anything that appealed to the popular fancy so well and offered opportunities for financial gain. The publicity of these few mixed with the reliable information from the preponderance of the industry resulted in public concepts based on confusion and even misinformation. Such a state of public knowledge has resulted in proposed state laws which prohibited cloud seeding because it caused droughts on the one hand and repetition because it caused floods on the other hand.

It is the purpose of the symposium on "Weather Modification in Arid Lands" to acquaint scientists in other fields and through them the general public with a true picture of the facts and state of development of the science of weather modification as applied to arid lands.

Joel E. Fletcher, Vincent J. Schaefer, Roscoe R. Braham, Jr., Eugene L. Peck, Lyle D. Calvin, Charles F. Cooper, Emery N. Castle, J. B. Stevens, Robert B. Ellert, Archie M. Kahan, and Werner A. Baum.

AAAS GENERAL SYMPOSIA

Michael Faraday—Natural Philosopher (26, 29 Dec.)

Arranged by Raymond J. Seeger (National Science Foundation).

August 25, 1967, marked the 100th anniversary of the death of Michael Faraday. Despite his lack of formal education, this amazing man made many significant contributions to the intellectual history of mankind in the 19th century. The present symposium regards him from the vantage points of different professions today: a historian of science, a physical chemist, a theoretical physicist, an engineer, and a teacher of physics. In addition, the symposium will have a lecture demonstration, utilizing some of the original Faraday equipment, by Ronald King of the Royal Institution of London, where Faraday devoted his life to understanding physical phenomena. Faraday materials are being arranged for a public exhibition in the Abbey Rockefeller Hall of Rockefeller University.

William W. Havens, Jr., L. Pearce Williams, Ralph E. Gibson, Richard M. Bozorth, Nathaniel Frank, Ernest Weber, Raymond J. Seeger, and Ronald King.

Is Defense against Ballistic Missiles Possible? (26–27 Dec.)

Arranged by Leonard S. Rodberg (University of Maryland).

The nature and potential effectiveness of currently proposed antiballistic missile systems will be discussed.

The desirability of a defense against ballistic missiles will be discussed. Its impact on strategic stability and the nuclear arms race, upon U.S. foreign relations, and upon future world security will be analyzed.

Richard L. Garwin, Hans A. Bethe, Daniel Fink, Freeman

Dyson, Marvin Kalkstein, Philip M. Farley, Donald G. Brennan, George Rathjens, Adam Yarmolinsky, and Glenn Kent.

Crime, Science, and Technology (27–29 Dec.)

Arranged by Joseph F. Coates (Institute for Defense Analyses) and James Osterburg (Visiting Professor, School of Criminology, University of California).

Topics: Forensics and Criminalistics; New Perspectives in Law Enforcement; Some New Technology in Law Enforcement; Riots and Urban Mass Violence I; Riots and Urban Mass Violence II; and Panel Discussion on the Expanding Role of Science and Technology in Law Enforcement and Criminal Justice.

Within the next decade, the systematic application of science and technology may well become the dominant theme in law enforcement and the administration of criminal justice. This symposium calls attention to some trends and opportunities for developments in this field and highlights some of the limitations in the expanding involvement of science and technology in criminal justice.

Scientific crime detection is one of the oldest and best established applications of science to law enforcement. But this field is not stagnant. The first session will review the present state-of-the-art from a number of points of view and highlight the dominant themes now unfolding.

Three new perspectives in the system of criminal justice will be considered in the second session. Local control of law enforcement as a major, if not necessary, feature in the preservation of democratic order in the United States is a widely and steadfastly held belief. Comparative studies may shed significant light on the feasibility, advantages, and risks in alternate organizations and approaches. Contemporary economic techniques have been sparsely applied to law enforcement, in part, for want of adequate measures, i.e., quantifiable criteria of success and failure. Progress is being made, measures are being developed, so that the methods of economists may become as powerful tools in law enforcement as they are in the civilian and military sectors. The more immediate problems of allocating limited resources at the disposal of any police force and some attempts at the rational solution of this problem will be discussed.

Communication and identification are perennial, major concerns of the police. Voiceprints and voice individuality are typical of new areas in technology applied to law enforcement, while the combination of identification and communication techniques is exemplified in the novel development of the New York State Intelligence and Identification System.

The prospect for controlling narcotics addiction through science will be discussed in terms of recent legislation.

Non-lethal weapons and other technological developments offer promise in moderating violence in law enforcement.

Games, including various forms of playacting and role-taking are emerging as a potentially major technique for rehabilitation, crime prevention, personnel selection, and training.

The past summers of violence have evoked practical and theoretical interest in rioting and urban mass violence. A cross section of investigators will present, from their personal and professional perspectives, what is known or could be made known on the origin, development, proliferation, prevention, and extinguishment of urban mass violence.

A distinguished panel, representing complementary perspectives of law enforcement, criminal justice, and science will discuss the opportunities and risks inherent in the expanding role of science and technology in law enforcement and criminal justice.

James Osterburg, Ralph Turner, Paul L. Kirk, Walter C. McCrone, Michael Bayard, Cyril Wecht, Charles Petty, and Alexander Joseph.

Joseph F. Coates, Raymond Galvin, Gordon Misner, Richard B. Hoffman, Robert Riggs, and W. Michael Mahoney.

Cecil Frost, Charles Kingston, Paul Veillette, Charles Robinson, Daniel Glaser, Regina Herzlinger, and Robert Rea.

Louis Masotti, Allen Grimshaw, John Spiegel, and Maier Tuchler.

Elliott Rudwick, James Laue, Joseph Lohman, and Thomas Tomlinson.

James Scheuer, Alfred Blumstein, Sanford Garelik, John Pemberton, and Daniel H. Watts.

Marine Science (27–28 Dec.)

Arranged by Arthur E. Maxwell (Woods Hole Oceanographic Institution) and Edward Wenk, Jr. (National Council on Marine Resources and Engineering Development).

Topics: Marine Science Affairs—Policies and Concepts; National Programs—A Look Toward the Future; Frontiers of Marine Science; and Food from the Sea.

The symposium on Marine Science will present a current picture of the diverse activities taking place in this rapidly growing area of science. The first session will concern itself with some of the policies and concepts being discussed within the federal government. Representatives of several of the agencies having major programs in this field will discuss areas to which particular attention is being given, each of which is of prime importance in the national oceanographic program now being formulated.

The next session will look at some programs that are developing on a national basis. Education, engineering, prediction, and deep-sea drilling promise to have a significant impact on the future of marine science in this country.

There will be a session devoted to two research programs that have captured the imagination of many marine scientists: ocean variability and the hypothesis of sea floor spreading. Most of the historical work in oceanography has been directed toward the determination of what one might call an average picture of the ocean. We have now reached a stage where our present knowledge and technology allow us to look into the deviations from this average condition, and results of this work are proving to be extremely interesting. The sea floor spreading hypothesis is based on the results of many different observations that have been made on the mid-ocean rises and ridges. As is often the case, these results are open to different interpretations, and cases both for and against sea floor spreading will be presented.

The last session concerns the possibility of using the living resources of the sea to provide protein-rich food for the undernourished areas of the world. Federal programs that

are being initiated in this area will be discussed along with potentialities and limitations of this resource.

Edward Wenk, Jr., Robert Frosch, Stanley Cain, Robert White, and Herman Pollack.

I. E. Wallen, Robert Abel, John Craven, Eugene E. Aubert, and Charles Drake.

Hugh McLellan, Nicolas P. Fofonoff, John Isaacs, Frederick Vine, and J. Lamar Worzel.

H. Burr Steinbach, Milner Schafer, G. K. Parman, John Ryther, and Donald Snyder.

Man and Transportation (27–30 Dec.)

Arranged by Paul Rosenberg (Paul Rosenberg Associates, Pelham, N.Y.; *Chairman*, Section M—Engineering), Newman A. Hall (Commission on Engineering Education, Washington, D.C.; Secretary, Section M—Engineering), and Walter G. Berl (Applied Physics Laboratory, Johns Hopkins University).

Topics: Opening Addresses; Traffic Flow and Congestion; Ground Transportation: Possibilities and Probabilities for Future Development; Future Modes of Air Transportation; Promising Urban Transportation Technology; Interaction of the Physical and Social Sciences in Transport Planning; Health and Transportation; and Automotive and Air Safety.

The problems of modern transportation are more than the engineering problems of designing and constructing automobiles, highways, aircraft, airports, and ships. Transportation involves problems of sociology, economics, ecology, population distribution, and health. In the conviction that many scientific disciplines can make significant contributions to these problems, the Engineering Section (M) of the AAAS has arranged a series of eight interdisciplinary symposia on "Man and Transportation."

The symposia will cover the subjects of: traffic flow and congestion on the highways, in the cities, and in the air; future modes of ground and air transportation; relations of transportation to ecology, urban development, and health; and automobile and air safety. These symposia will be directed primarily to the interests of the multidisciplinary audience which distinguishes an AAAS meeting, and secondarily to transportation specialists. For example, some of the papers discuss: air pollution from automobiles; psychology of automobile accidents; agriculture and transportation; statistics and mathematics of traffic flow; electric- and nuclear-powered automobiles; and the SST.

Claiborne Pell, Constantinos A. Doxiades, and Colin Buchanan.

Roger H. Gilman, Denos G. Gazis, Martin A. Warskow, R. M. Thomas, and Henry A. Barnes.

Siegfried M. Breuning, Richard H. Shackson, Aaron J. Gellman, Victor Wouk, and William W. Seifert.

Raymond L. Bisplinghoff, Arnold F. Kossar, John Stack, H. G. Edler, and Stephen G. Saltzman.

Sumner Myers, Morton I. Weinberg, Kay L. Neilson, William H. Avery, Maurice Sulkin, and John D. Garcia.

Robert P. Whorf, Edwin T. Haefele, Marvin Manheim, and Donald P. McKinnon.

W. G. Berl, E. S. Starkman, J. K. Patterson, Peter A. Franken, and Peter V. Siegel.

Jerome Lederer, Robert Brenner, Ross A. McFarland, and John P. Stapp.

Do Life Processes Transcend Physics and Chemistry? (30 Dec.)

An informal discussion between Gerald Holton, Michael Polanyi, John R. Platt, Ernest Nagel, and Barry Commoner will be held.

MATHEMATICS (A)

Computer-Aided Research (28 Dec.)

Arranged by Wallace Givens (Argonne National Laboratory).

The digital computer has, in two decades, become a familiar tool to many working scientists. Imaginative and extensive use of the varied capabilities of a computer system as an integral part of theoretical research is the unifying theme of this Symposium.

Cyrus Levinthal will use computer-generated films to show the structure of small molecules as well as of proteins. He will describe his employment of time-sharing techniques in order to provide opportunity for observation and modification of structures as an essential part of this research.

Don L. Bunker will report on his studies of the rates and dynamics of chemical reactions using Monte Carlo techniques to accumulate information on randomly selected reaction events. Computer results will be compared with the outcome of molecular beam experiments as well as, in other cases, with predictions of theory. Both high arithmetic speed and large memory capacity are required, with some trade-off of one for the other possible.

Part of the original impetus for the development of the modern digital computer came from the need to calculate at Los Alamos certain time-dependent fluid flows. The solution by difference-approximation methods of partial differential equations has continued to make heavy demands on the most powerful machines. Numerical experiments in fluid dynamics with output direct from the computer on film will be reported by C. W. Hirt.

Wallace Givens, Cyrus Levinthal, Don L. Bunker, and C. W. Hirt.

Second Annual Symposium on Mathematical Questions in Biology (27 Dec.)

Arranged by the Joint Committee on Mathematics in the Life Sciences.

Murray Gerstenhaber (University of Pennsylvania), *Chairman*; Hans J. Bremermann (University of California, Berkeley); and Alston S. Householder (Oak Ridge National Laboratory)

The use of appropriate parts of mathematics in studies of ecological equations, mating behavior in animals, and neural networks illustrates the broad applicability of the subject in the biological sciences. Thus, Robert H. MacArthur employs graphical analysis, William Bossert uses stability concepts, and J. D. Cowan finds differential equations, Hamiltonian mechanics, and Gibbsian statistical mechanics appropriate.

Murray Gerstenhaber, Robert H. MacArthur, William Bossert, and J. D. Cowan.

Research Topics in Computer Science (27 Dec.)

Arranged by A. J. Perlis (Carnegie-Mellon University, Pittsburgh).

The three papers of this symposium treat some of the more important phenomena surrounding computers. Each, while specific, can be thought of as exemplary of problem, point of view, and technique.

Every use of the computer requires translation into a symbolic representation which is adequate, that is, sufficient for the solution of the problem, and mechanical, and capable of being correctly manipulated entirely within the computer by resident programs. When the problems have a classical mathematical flavor, the choice of representation is so familiar that it need not be studied. When the problems are related to problem-solving itself, the computer representation of data and tools becomes crucial and worthy of deep study. The first paper deals with this phenomenon.

While each computer program is specific, the concept of a program and a task can be abstracted to study important properties common to all programs. Thus each program requires the resource of storage and utilizes time. It is important to determine lower bounds on the time and storage required by certain classes of programs and, conversely, to study the properties of programs which have such lower bounds. The second paper considers this aspect of computer science.

The computer with its programs is a part of the apparatus of scientific research. As our understanding of symbolic modeling deepens, it is natural to expect the computer to become increasingly imbedded in the research process and more dedicated to automatic response to the demands of the user discipline. Nowhere is this more apparent than in the studies where the refining of bulk data is necessary to reveal the "precious" result. High-energy physics relies on such extraction processes for which the computer is crucial. The third paper treats the artistic imbedding of the computer in the process of high-energy physics research.

Finally, the chairman will summarize and relate these three aspects to each other, since each uses phenomena studied by the other two, and to the other phenomena which now occupy the attention of computer scientists.

Saul Gorn, Allen Newell, Juris Hartmanis, and William Miller.

PHYSICS (B)

New Useful Developments Derived from Recent Pure Research in Physics (29 Dec.)

Arranged by W. W. Havens, Jr. (Columbia University).

The new devices and technologies resulting from pure research in physics often come as a surprise to the scientists investigating the phenomena. Unfortunately, the benefits society ultimately realizes are not and cannot be predicted when the research is begun. The motivation behind the physicist doing basic research is obtaining a better understanding of the phenomenon he is investigating. He would like to be able to exactly predict the results of an experiment on the basis of some reasonable theory which assumes no more than the fundamental laws of physics. On the forefront of research, the current theories are either incapable of predicting the experimental results or allow for so many possible results that the true answer may only be obtained by controlled experimentation.

There are many examples, of discoveries which directly affect our day-to-day lives. A long interrelated series of theoretical and experimental trials designed to more fully understand the behavior of solids resulted in the invention of the transistor. Our electrical power and communications systems have been substantially improved by discoveries resulting from research in plasma physics. In one of the most recent examples, the study of the structure of molecules and the mechanism which binds them in solids resulted in the invention of the Maser and the Laser.

The speakers at the symposium on "New and Useful Developments Resulting from Pure Research in Physics" will show how research designed to study a specific phenomenon can produce useful and unexpected results. The four speakers are well acquainted with their respective specialties, which are nuclear physics, solid state physics, plasma physics, and atomic and molecular physics. Each speaker will give illustrations of how the curiosity of physicists resulted in new and useful developments in the past and in what areas such developments might occur in the future.

Polykarp Kusch, W. W. Havens, Jr., John Marshall, Rolf Landauer, and Charles H. Townes.

Exobiology: the Search for Extraterrestrial Life and Its Biological and Sociological Implications (30 Dec.)

Arranged by Martin M. Freundlich (Airborne Instruments Laboratory, Deer Park, N.Y.).

The panel will discuss the physical environment of the planets of the solar system with reference to their habitability by indigenous organisms and give a critique of ground-based attempts to detect extraterrestrial life with particular attention to the planet Mars. The speakers will discuss the integrated experiments that must be performed in order to determine whether life exists on any of the planets. Life detection packages that can serve as automated laboratories to perform metabolic experiments will be described. The problems of preventing contamination of extraterrestrial bodies and their impact on space programs will be discussed.

The electromagnetic processes that are of importance in the search for intelligent extraterrestrial life will be reviewed. The possibility of exploiting the 1420 Mhz line of atomic hydrogen and the four lines of OH at approximately 1700 Mhz for interstellar communication will be scrutinized. The present status of techniques and observations in this field will be summarized and possible future refinements will be reviewed. Methods of distinguishing information from intelligent beings from signals of natural origin will be discussed. The panel will speculate on the forms that life may have taken outside of our planet. Our present concepts on unicellar development will be applied to this problem. Assuming that extraterrestrial life does indeed exist, a variety of philosophical, sociological, and biological implications arise. To what extent is our society prepared for these problems?

Bernard Wagner, Carl Sagan, Richard S. Young, Gilbert Levin, Everett M. Hafner, Henry D. Isenberg, and Wolf Vishniac.

The Role of the Tropics in the General Circulation of the Atmosphere (29 Dec.)

Arranged by Henry M. E. van de Boogaard and Edward D. Zipser (National Center for Atmospheric Research, Boulder, Colorado).

Postwar developments in meteorology have depended in large part on the electronic computer. Computer studies have led to better physical understanding of temperate-latitude atmospheric circulations and to dynamic modeling which has made numerical weather prediction possible for these latitudes.

Until now meteorological research in the tropics has not benefitted a great deal from these developments, largely because of the lack of sufficient observations to diagnose the far more complex structure of the tropical atmosphere.

The tropics constitute a great heat engine which is partly responsible for driving the global atmosphere. Much of the solar heat received by the tropical ocean and land surfaces is released to the lower layers of the atmosphere by contact, evaporation and radiation. This heat is then further transported to the higher layers of the tropical atmosphere by means of cumulus cloud convection, and also by radiation. In turn, this accumulated energy is gradually transported poleward and transformed into kinetic energy, experienced in the form of wind or air currents.

Highly organized and intense tropical cumulus cloud development sometimes leads to development of tropical storms and hurricanes. These in essence are safety valves which provide the tropical atmosphere with another method of releasing its accumulated energy.

The locations of these regions of organized cumulus convection are essential data for tropical weather analysis. The recent synchronous ATS-1 (Applications Technology Satellite) satellite with its cloud camera has shown the way for ultimate instantaneous global cloud observations.

New technology such as the ATS-1 has encouraged scientists to have another look at the tropics. Future research programs, like the recently completed Line Islands Experiment, will provide a much more complete understanding of the behavior of the tropical atmosphere.

Louis J. Battan, Henry M. E. van de Boogaard, Edward D. Zipser, Robert H. Simpson, Joanne Simpson, Tetsuja Fujita, and Dorothy L. Bradbury.

CHEMISTRY (C)

Present State of the Art (27 Dec.)

Arranged by H. F. Mark (Polytechnic Institute of Brooklyn) and S. M. Atlas (Bronx Community College).

James E. McEvoy, *Catalysis: Present State of the Art.*

David Harker, *X-ray Crystallography as a Chemical Discipline.*

Sir Robert Robinson, *Recollections of Sixty Years of Organic Chemical Research.*

H. F. Mark, *Synthesis and Uses of Organic Polymers.*

Chemistry and Urban Problems (29 Dec.)

Arranged by H. F. Mark (Polytechnic Institute of Brooklyn) and S. M. Atlas (Bronx Community College).

J. M. Campbell, *Transportation.*

F. D. Rosi, *Communications.*

Fred Leonard, *Rehabilitation and Biomedicine.*

Self-Assembly of Matter (29 Dec.)

Arranged by Sidney W. Fox (University of Miami).

The program on Self-Assembly of Matter is concerned with the ways in which matter, especially biological matter, tends to organize itself structurally. Some of the most striking examples of this tendency are found at the level of protein molecules and of models of primitive cells. Are such tendencies discernible at more fundamental chemical and physical levels?

Sidney W. Fox, Victor Weisskopf, William N. Lipscomb, Lester J. Reed, and Angus Wood.

ASTRONOMY (D)

Plasma Astrophysics (27 Dec.)

Arranged by Russell Kulsrud (Plasma Physics Laboratory, Princeton University).

The subject of plasma astrophysics comprises those areas of astrophysics in which a thorough knowledge of plasma effects is needed for understanding and interpretation. Such areas are the mechanism for cosmic and solar radio emission; the origin and behavior of cosmic rays, and the effect they play on structure of the galaxy; the influence of the supernovae and H-II regions on the latter; solar activity and the resulting solar wind with its terrestrial interaction producing storms; and many other areas of astrophysics. In recent years, there has been a growing appreciation of the fundamental importance of the newer developments in plasma physics in understanding these phenomena and a new subject of plasma astrophysics is growing up and attracting both astronomers and plasma physicists. It seems appropriate at this time to have a symposium in which experts in a variety of subjects in this field review these subjects. For this reason, the symposium consists of a number of somewhat unrelated topics to illustrate the broad scope of the subject.

Bruno Coppi, A. J. Dessler, Derek Tidmann, Russell Kulsrud, Barry Lasker, and Eugene Parker.

Structure and Evolution of our Universe (28 Dec.)

Arranged by Hong-Yee Chiu (Goddard Institute for Space Studies and State University of New York at Stony Brook).

In this symposium, the current status of cosmology will be reviewed by experts in this field. Chiu will review cosmological theories as originally formulated by Friedman, with emphasis on observational properties of the Universe. Thorne will discuss some new ideas in cosmological theories, including anisotropic models. Wilkinson will discuss radio observations of the Universe, including some new results obtained recently on the 3°K black body radiation. Kristian will summarize astronomical observations dealing with the gross structure of the Universe.

Hong-Yee Chiu, Kip S. Thorne, David T. Wilkinson, and Jerome Kristian.

Lloyd V. Berkner Memorial Symposium on Evolution of the Earth's Atmosphere (27 Dec.)

Arranged by S. I. Rasool (Goddard Institute for Space Studies, New York City).

Both biochemical arguments and geological evidence strongly suggest that the atmosphere of the earth has undergone major evolutionary changes during its long history. There is convincing evidence that the present atmosphere and hydrosphere arose largely from the earth's interior by volcanic emanations. But the sequence of events which led to present-day composition of N_2 and O_2 has yet to be established. What is the history of volatiles now present at the surface of the earth? Has the carbon, nitrogen, oxygen, and hydrogen always been in the form of CO_2, N_2, H_2O, and H_2, or did carbon and nitrogen combine with hydrogen early in the earth's history to form CH_4 and NH_3? Under what atmospheric conditions did life originate on earth and how did the appearance of life change the atmosphere?

Despite disagreement over the composition of the primitive atmosphere, it is almost certain that it was devoid of free oxygen. The late Lloyd V. Berkner and L. C. Marshall have presented detailed calculations indicating that free oxygen was limited to about 0.1 percent of the present atmospheric level during the entire prebiological history and accumulated slowly to the present amount since the start of photosynthesis. Difficulties arise, however, when one attempts to construct an evolutionary model of the atmosphere which would be consistent from the prebiological period to the present. Some of these important questions will be discussed in the symposium.

Harrison Brown, P. Cloud, S. I. Rasool, W. E. McGovern, S. W. Fox, L. C. Marshall, and H. D. Holland.

GEOLOGY AND GEOGRAPHY (E)

Earth Sciences in Secondary Schools (27 Dec.)

Arranged by G. Gordon Connally (Lafayette College and SUNY, College at New Paltz).

John H. Moss, Kurt E. Lowe, Roger W. Ming, Irving L. Horowitz, Whitman Cross II, Harold C. Fry, Jr., Archie W. Pollock, David L. Kendall, G. Gordon Connally, Anastasia Van Burkalow, Samuel N. Namowitz, John F. Thompson, Richard P. Boekenkamp, Joseph J. Fratamico, and Kenneth F. Bick.

Geography and Policy Research (30 Dec.)

Arranged by Gordon E. Reckord (Division of Earth Sciences, National Research Council).

Saul B. Cohen, Gordon E. Reckord, Edward M. Risley, Arch C. Gerlach, Wolfram U. Drewes, Victor Roterus, and Lewis M. Alexander.

Cave Geology; Ecology of Cave Animals; and Cave Geography and Exploration (29–30 Dec.)

Arranged by William B. White (Pennsylvania State University).

William B. White, Victor R. Baker, George H. Deike, John M. Rutherford, Jr., G. E. Eddy, D. B. Williamson. Thomas L. Poulson, Ronald A. Brandon, Stewart Peck, Thomas Jegla David Culver, and Robert Mitchell.

John R. Holsinger, Roger Barody, and Douglas Medville.

ZOOLOGICAL SCIENCES (F)

Sharing as a Genecological Process (30 Dec.)

Arranged by Pierre Dansereau (New York Botanical Garden, Bronx) and H. G. Baker (University of California, Berkeley).

Interactions between organisms in biotic communities have more often been investigated in terms of deleterious consequences than advantageous ones. There is a growing body of evidence, however, that positive interactions do occur. Very little attention has been paid to the evolutionary processes which bring about the adjustment of taxonomically distinct organisms so that they share rather than compete for natural resources. What we are concerned with is the opposite of the character-displacement. The symposium may very well examine what evidence exists for sharing in nature and the genecological processes which increase its efficiency.

H. G. Baker, Daniel Janzen, Lincoln Brower, and Pierre Dansereau.

Environmental Input and Endocrine Activity (27 Dec.)

Arranged by A. van Tienhoven (Cornell University).

All the phenomena which are observed in the animal kingdom are the result of interactions between the inherited characteristics of the animal and the environment. It is the purpose of this symposium to consider a small part of these phenomena, that is, the effects of the environment, and the manner in which the environment is able to affect the function of the endocrine system of animals.

The endocrine system was selected because it is one of the coordinating systems and many interactions with the other coordinating system, that is, the nervous system, have been studied.

By giving consideration to separate inputs, that is, light, touch, smell, a deeper understanding can be obtained concerning some of the mechanisms by which endocrine phenomena are affected. The similarities, differences, and the adaptive signficance of these phenomena will receive particular attention, as is evident from the fact that vertebrates and invertebrates are to be discussed.

A. van Tienhoven, H. Karten, S. J. Berry, W. M. Hamner, P. Licht, D. Aiken, D. S. Lehrman, B. Scharrer, C. A. Barraclough, F. Engleman, F. H. Bronson, T. Eisner, B. Brockway, and W. Loher.

Control Mechanisms in Morphogenesis (29 Dec.)

Arranged by Malcolm S. Steinberg (Princeton University).

As Johannes Holtfreter retires from teaching and turns his scholarly efforts entirely to research, his colleagues honor him through this symposium.

Jane M. Oppenheimer of Bryn Mawr College will review how our understanding of "Cells, Organizers, and Organization" has evolved during the past 50 years, over which Holtfreter's important contributions have been spread.

J. T. Bonner of Princeton University will discuss the evidence demonstrating chemotaxis in the cellular slime

molds. His presentation will include recent evidence from his laboratory concerning the chemical identity and action of "acrasin," the chemotactic agent which signals the individual, free-living amoebae to aggregate and to differentiate and organize into a multicellular organism.

Malcom S. Steinberg, also of Princeton University, will present new experiments from his laboratory which are an extension of earlier experiments by Holtfreter. The findings indicate that the same physical principles which operate to control the self-assembly of macromolecular subunits into higher cell or viral structures also operate to guide major steps in the organization of the vertebrate body during embryonic development.

Viktor Hamburger, Jane M. Oppenheimer, J. T. Bonner, Theo M. Konijn, Malcolm S. Steinberg, and J. Lawrence Kelland.

Refresher Course: Principles of Ecology for Bio-Environmental Engineers (27 Dec.)

Arranged by Rezneat M. Darnell (Marquette University) and Theodore A. Olson (University of Minnesota).

The community of ecologists is becoming progressively concerned over the impact of civilization upon natural ecosystems. Increasing population pressure, together with expanding technology, are posing threats whose directions and magnitudes must be assessed, not only on the local, but on the worldwide scale. Few ecologists, however, are in positions to retard the effects of environmental modification which are becoming so apparent to all.

The community of environmental engineers is itself the agent which plans and executes many environmental modifications, which provides for the wastes of civilization, and which carries out programs for the assessment of tolerance levels for environmental disturbance. Increased communication between the ecologist and the environmental engineer is essential to the optimal long-term management of our limited environmental resources.

The present refresher course is an attempt to strengthen this dialogue. Principles of community and ecosystem-ecology will be presented in some detail and their engineering implications discussed. The community under stress will be examined from both ecological and engineering standpoints.

George L. Clarke, Robert G. Wetzel, David E. Reichle, Thomas D. Brock, and Frank B. Golley.

Eugene P. Odum, George M. Woodwell, Robert H. Whittaker, Richard S. Englebrecht, Willis E. Pequegnat, Stanley I. Auerbach, and Frederick E. Smith.

Alfred F. Bartsch, Howard T. Odum, Gordon M. Fair, John E. Cantlon, and Conrad P. Straub.

Animal Communication (28 Dec.)

Arranged by Neal A. Weber (Swarthmore College).

Animal communication may take auditory, visual, tactile, biochemical or some combination of forms, both between members of a species or between unrelated species. The organism receives information from the external environment, a signal is made, and the animal perceives it, responding appropriately.

The advent of refined instrumentation and more critical approaches have markedly increased our knowledge of animal communication. The biochemistry of the signals, their origins and methods of transmittal, the receptors, the neural mechanisms are all being investigated intensively in both vertebrates and invertebrates.

Neal A. Weber, Robert Capranica, William F. Martin, W. John Smith, R. Allen, Beatrice T. Gardner, Vincent G. Dethier Thomas Eisner, and Edward O. Wilson.

Terrestrial Adaptations in Crustacea (27–29 Dec.)

Dedicated to the memory of Warren J. Gross, a leading investigator in the field of crustacean terrestrial adaptations.

Arranged by Dorothy E. Bliss and Linda Habas Mantel (American Museum of Natural History, New York City).

The Transition from Water to Land in Three Major Groups.

Adaptations Concerned with Osmoregulation and Water Balance.

Adaptations Concerned with Temperature, Respiration, and Circulation.

Adaptations of Metabolism.

Adaptations of Water Conservation and Behavior.

Adaptations of Sensory Perception and Behavior.

In the past 5 years there has been a marked rise in interest in the adaptive characteristics of crustaceans that have invaded the intertidal zone and the land above the

Vice-Presidential Addresses

Mathematics—A. M. Gleason: "Symmetry, the Scientist's Friend," 30 Dec.

Physics—W. W. Havens: "Nuclear Physics Research as a Source of Technology," 29 Dec.

Chemistry—H. F. Mark: "Are There Limits to Polymer Research?" 27 Dec.

Geology and Geography—Joe Webb Peoples: "Geology in State Governments," 27 Dec.

Zoological Sciences—C. S. Pittendrigh: "Time and Life," 29 Dec.

Botanical Sciences—W. C. Steere: "The Evolutionary Position of the Bryophyta," 29 Dec.

Anthropology—Alexander Spoehr: "Anthropology Today," 27 Dec.

Psychology—L. J. Postman: "Mechanisms of Interference in Forgetting," 30 Dec.

Social and Economic Sciences—David B. Truman: "The Social Sciences: Maturity, Relevance, and the Problem of Training," 29 Dec.

History and Philosophy of Science—P. J. Caws: "Structure, Statistics, and the Logic of Discovery," 30 Dec.

Dentistry—L. R. Cahn: "Global Oral Pathology," 28 Dec.

Pharmaceutical Sciences—Curtis Waldon: "Pharmacy and the Developing Federal Programs," 29 Dec.

Industrial Science—Ellis A. Johnson: "Ethical Dilemmas in the Applications of Operations Research toward the Organizational Behavior of Very Large Systems," 28 Dec.

Education—Herbert A. Smith, "Fallout from a Decade of Criticism in Science Education," 27 Dec.

Information and Communication—P. V. Parkins: "Confessions of a Communications Non-Conformist," 29 Dec.

Statistics—G. E. P. Box: "Science and Statistics," 29 Dec.

tides. Considerable research on these animals is now under way. This symposium will bring together for the first time almost all of the investigators currently active in the field, including several from abroad.

Varying degrees of terrestriality have been achieved by three major groups of crustaceans. In the first session of the symposium, speakers will describe the progress made by these three groups.

With the groundwork for the symposium presented, the remaining sessions of the symposium will then consider in more detail various aspects of the physiology, ecology, and behavior of terrestrial crustaceans. The papers will deal mainly with isopods and decapods, on which most experimental research has been and is being done.

A feature of each session will be a general discussion at its conclusion.

F. John Vernberg, E. B. Edney, Desmond E. Hurley, Dorothy E. Bliss, E. L. Bousfield, and G. W. Wharton.

Frederick A. Kalber, John D. Costlow, Jr., C. G. Bookhout, Paul P. Rudy, D. Eugene Copeland, Linda Habas Mantel, and Betty J. Wall.

W. B. Vernberg, Don Curtis Miller, James R. Redmond, Leonard Stutman, Marilyn Dolliver, John Mark Dean, John M. Augenfeld, and Oscar H. Paris.

Dorothy M. Skinner, Wolfgang Wieser, Roy Hartenstein, Charles A. Gifford, John D. O'Connor, Lawrence I. Gilbert, and Edward J. de Villez.

E. B. Edney, Michael R. Warburg, K. Ranga Rao, Franklin H. Barnwell, William Herrnkind, E. B. Edney, and Milton Nathanson.

Helen Ghiradella, James Cronshaw, James Case, Howard O. Wright, Michael Salmon, Samuel Atsaides, Hermann Schöne, June F. Harrigan, Brian A. Hazlett, and Howard S. Hodgson.

Web-Building Spiders (29–30 Dec.)

Arranged by Peter N. Witt (North Carolina Department of Mental Health, Raleigh).

Spider Silk and Spinning.

Central Nervous System Anatomy and Function: The Vibration Receptor.

Poisons, Traps, Prey-Catching Behavior.

Webs and Web-Building.

The geometric orb web which certain species of spiders build every morning has been investigated as a record of the animal's behavior. Complexity as well as uniformity of shape, species specificity and changing of the pattern with age, disturbances of geometry through bodily injury or through changes in body chemistry by drugs, have offered a special opportunity to analyze changes in behavior. The symposium constitutes the first meeting of scientists with diverse backgrounds whose work has contributed to the understanding of web-building. Silk synthesis, thread extrusion, and their regulation are first discussed from the biophysical, chemical, and anatomical angle. The central nervous system of spiders, its structure as well as function, is explored as an organ in which incoming signals from various receptors are processed, and where the leg movements are regulated for positioning of the thread. Webs are only a special form of traps, and other prey-catching tools of spiders, including their poisons, form the topic of a third session. In the final session, the time sequence of orb construction, its plasticity as well as rigidity, and the mathematical and computer approach to the elucidation of web geometry are explored. The discussion should lead to better understanding of spiders and to the formulation of general rules of body-behavior interaction in animals.

Peter N. Witt, David B. Peakall, R. M. Langer, W. B. Eberhard, V. L. Friedrich, Ronald Wilson, A. Shulov, and Gershon Levi.

Charles F. Reed, K. Sasira Babu, Charles Walcott, and Louis Leguelte.

Hans M. Peters, John McCrone, Wolfgang Buecherl, Michael Robinson, Harro Buchili, Jonathan Reiskind, and Bertrand Krafft.

William Eberhard and Samuel Bays.

Functional Morphology of the Vertebrate Heart (28 Dec.)

One of the most important functions of the vertebrate circulatory system, and hence of the heart, is the distribution of oxygenated blood to all parts of the body. Thus any changes in the respiratory apparatus must be reflected in the circulatory system. In most fishes gills form the main respiratory surface, and the circulation is arranged as a single circuit with the blood passing from the heart to the gills to the body to the heart. However, in lungfish and tetrapods, lungs largely or entirely replace the gills and a new arrangement must be developed. In birds and mammals a complete two-circuit system—heart to lungs to heart to body to heart—is achieved, but in lungfish, amphibians, and reptiles various "compromises" are found. In this symposium the various problems in delivering oxygenated blood to all parts of the body and in keeping it separated from the non-oxygenated blood and the ways in which different vertebrates have met them will be discussed.

Thomas S. Parsons, David Randall, David Hanson, Kjell Johansen, Fred N. White, and Ursula Rowlatt.

Radiation and Behavior (29 Dec.)

Arranged by Howard Vogel, Jr. (University of Tennessee).

Donald J. Kimeldorf, James C. Smith, Gary S. Shaber, Robert L. Brent, James A. Rumsey, Gail Newingham, John R. Tester, D. B. Siniff, Orrin J. Rongstad, Ernest Furchgott, and Sylvan J. Kaplan.

Primary Productivity and Mineral Cycling in Natural Ecosystems (27 Dec.)

Arranged by Harold E. Young (University of Maine).

There is a growing awareness by mankind that the most critical problems facing the world are population growth, 2 percent per year, and rapid deterioration of man's environment. The solutions to these problems and their corollaries challenge the efforts of scientists and nonscientists alike. To solve these problems, research must first be conducted by scientists within a number of separate disciplines. The results must then be integrated into a series of action programs with little time before such programs must go into effect.

The environment is of concern to many scientific dis-

ciplines, particularly ecologists. Ecologists are currently obtaining basic information on primary productivity and mineral cycling of natural ecosystems. This information will be the basis for producing more food and fiber to meet the requirements of the rapidly increasing world population and to prevent further damage to natural ecosystems as well as the rehabilitation of ecosystems that have deteriorated.

Internationally known scientists will present general principles and specific information on primary productivity and mineral cycling in natural ecosystems. If these scientists, by their accomplishments, can encourage others to add to the limited pool of knowledge in this area, then a significant step forward will have been made in the solution of these major world problems: overpopulation and environment deterioration.

Harold E. Young, Afanasii I. Marchenko, Peter J. Rennie, Taisitiroo Satoo, Howard T. Odum, Bostwick H. Ketchum, Jerry S. Olson, Rudolph F. Scheltema, J. D. Ovington, F. H. Bormann, G. M. Woodwell, D. W. Cole, S. P. Gessel, S. F. Dice, R. H. Whittaker, and H. A. I. Madgewick.

A Coastal Marine Ecosytem: Diversified Ecological Approaches to Barnstable Harbor, Massachusetts (29 Dec.)

Arranged by David C. Grant and Roger H. Green (Marine Biological Laboratory).

This symposium has been arranged to draw together the existing ecological research on a single ecosystem, to synthesize the information within the context of modern ecological theory, and to point out any gaps in the present knowledge of a relatively well-known system. Barnstable Harbor is particularly appropriate because of the extensive studies carried out in the past several years by many persons utilizing diverse approaches. The symposium will consist of two half-day sessions of half-hour papers synthesizing the participant's individual research in Barnstable Harbor with any later or current marine ecological work. In addition to comments on the individual presentations, there will be a general round-table discussion and summary at the conclusion of the symposium.

David C. Grant, Alfred C. Redfield, J. Dungan Smith, Donald C. Rhoads, John D. Palmer, Charlotte P. Mangum, Charles E. Jenner, Rudolph F. Scheltema, Roger H. Green, Katherine D. Hobson, Eric L. Mills, and Howard L. Sanders.

Allelopathy Among the Higher Plants (30 Dec.)

Arranged by Pierre Dansereau (New York Botanical Garden, Bronx) and John Cantlon (Michigan State University).

The mechanism of evolution in vegetation differs from that in species in detail only. The selective pressures in each include antagonisms between organisms which may determine survival of specific genomes as well as interspecific associations. Allelopathy is a factor frequently responsible for such antagonisms and capable of controlling germination, ecesis, invasion, dominance, exclusion, and ultimate vegetational composition. The toxic products involved in allelopathy are controlled by habitat factors, both as to the kinds and quantities of toxins produced by plants and their persistence and effectiveness in the environment. Thus associations of plants may derive not only from coincidence of soil and climatic requirements but also from tolerance of one another's exudates which in turn are somewhat controlled by soil and climatic qualities.

John Cantlon, Cornelius Muller, H. B. Tukey, F. W. Woods, and Helmut Leith.

Adaptive Radiation in Aquatic Animals (28 Dec.)

Arranged by Arthur H. Clarke, Jr. (National Museum of Canada) and Alan H. Cheetham (U.S. National Museum).

Many aquatic animal groups have increased in diversity during Paleocene to Recent time by exploiting ecologic or biogeographic opportunities through acquisition of advantageous morphologic, physiologic, or behavioral features. Adaptive radiation, grounded in Cenozoic or earlier evolutionary events, is less well known in aquatic animals than in some terrestrial groups. Participants in the symposium will discuss neontologic and paleontologic views of adaptive radiation and will present evidence for rates of radiation and the functional bases of adaptation. Those groups of Recent invertebrates and vertebrates having a fossil record and occurring in a wide variety of freshwater and marine habitats will be emphasized.

Arthur H. Clarke, Jr., Eugene G. Munrow, Alfred S. Romer, Richard Cifelli, Alan H. Cheetham, John W. Wells, David Nicol, J. Wyatt Durham, G. Arthur Cooper, Richard H. Benson, E. L. Bousfield, Richard Lund, Alan Keast, Max K. Hecht, and Frank Whitmore, Jr.

Techniques for Comparative Studies of Protein Structure (29 Dec.)

Arranged by Charles G. Sibley (Yale University).

This symposium will concern the application of the techniques of protein chemistry, specifically structural techniques, to the study of systematic problems. Techniques which permit one to determine the sequence of amino acids in a polypeptide chain or which provide an index to part or all of the sequence will be discussed.

Charles G. Sibley, Richard A. Laursen, Russell F. Doolittle, and E. Margoliash.

Zoologists' Library and Book Lounge

The Zoologists' Library and Book Lounge will be open throughout the meetings as a lounge and informal meeting place. All zoologists are invited to visit this room and to examine the special exhibits arranged there. The Lounge again will feature the extensive collection of recent books and monographs on zoological subjects.

Books in the collection include works on all aspects of animal science: general zoology and biology texts, reference books, natural histories, works on principles and philosophical aspects of zoology, popular books and guides, periodicals, and monographs on specific groups of animals. The collection includes most of the books on animals currently in print in the English language.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PROGRAM OF THE 134TH ANNUAL MEETING
NEW YORK CITY 26-31 DECEMBER 1967

			DECEMBER 26 A.M.	DECEMBER 26 P.M.	DECEMBER 27 A.M.	DECEMBER 27 P.M.	DECEMBER 28 A.M.	DECEMBER 28 P.M.	DECEMBER 29 A.M.	DECEMBER 29 P.M.	DECEMBER 29 P.M.	DECEMBER 30 A.M.	DECEMBER 30 P.M.
AAAS INVITED LECTURES						FRONTIERS OF SCIENCE II H. LONSDALE (4:30)		FRONTIERS OF SCIENCE III R. REVELLE & PANEL (2:00)	GENERAL LECTURE H. KAHN (9:00)	GENERAL LECTURE H. KAHN PANEL (2:00)			NATIONAL GEOGRAPHIC (8:30) SOCIETY: FILM & LECTURE
						DISTINGUISHED LECTURE A. SPLHAUS (8:30)		SARTON MEMORIAL LECTURE C.S. SMITH (4:30)		RESA ANNUAL ADDRESS B. WOLMAN & PANEL (2:00)			
								ADDRESS RETIRING PRESIDENT A.S. ROMER (8:30)		GENERAL LECTURE B.F. SKINNER (4:15)			
										SIGMA XI - PHI BETA KAPPA E.A. WHEELER (8:30)			
AAAS COMMITTEE SYMPOSIA					← IODINE-131 FALLOUT →			← SECRECY, PRIVACY AND PUBLIC INFORMATION →				← WEATHER MODIFICATION IN ARID LANDS →	
AAAS GENERAL SYMPOSIA AND DISCUSSIONS				BALLISTIC MISSILE DEFENSE	← CRIME, SCIENCE AND TECHNOLOGY →								
					← MARINE SCIENCE →								LIFE PHYSICS AND CHEMISTRY
					← MAN AND TRANSPORTATION →								
				MICHAEL FARADAY						MICHAEL FARADAY			
MATHEMATICS	SECTION A	A					COMPUTER AIDED RESEARCH			A.M. GLEASON, V.P. (4:00)			
	AM. MATH. SOCIETY	A1			MATHEMATICAL BIOLOGY								
	ASSOC. COMPUT. MACHINERY	A2				COMPUTER SCIENCE							
PHYSICS	SECTION B	B							W.W. HAVENS, V.P. & USEFUL DEVELOPMENTS				
	AM. ASTRONAUTICAL SOC.	B1										← EXOBIOLOGY →	
	AM. METEOROL. SOC.	B2								TROPICS IN GENERAL CIRCULATION OF ATMOSPHERE			
CHEMISTRY	SECTION C	C			N.F. HIGH, V.P. AND STATE OF THE ART				SELF ASSEMBLY OF MATTER	URBAN PROBLEMS PANEL			
	AM. ASSOCIATION CLINICAL CHEMISTS	C1			CONTRIBUTED PAPERS	IMMUNOGLOBULINS							
ASTRONOMY	SECTION D	D			EARTH'S ATMOSPHERE	PLASMA ASTROPHYSICS	STRUCTURE OF UNIVERSE						
GEOLOGY	SECTION E	E			← EARTH SCIENCES IN SECONDARY SCHOOLS →	A.W. PEOPLES, V.P. (4:45)							
	ASSOC. OF AMERICAN GEOGRAPHERS	E1										← REPORT →	
	NATL. SPELEOLOGICAL SOC.	E2							CAVE GEOLOGY	ECOLOGY OF CAVE ANIMALS (1:30)	CAVE GEOGRAPHY		
	PALEONTOLOGICAL SOCIETY	E3					← ADAPTIVE RADIATION IN AQUATIC ANIMALS →						
ZOOLOGICAL SCIENCES	SECTION F	F						E.C. RAFFERTY					
	AMERICAN SOC. NATURALISTS	F1						PRESIDENTIAL ADDRESS					SHARING
	AMERICAN SOC. ZOOLOGISTS	F2				PAST PRESIDENT'S SYMPOSIUM	ANATOMY OF VERTEBRATE HEARTS			← WEB BUILDING SPIDERS →			
					← C.P. MISCELLANEOUS →	C.P. INVERT. ZOOL. (7:00)	← ANIMAL COMMUNICATION →		C.P. MISCELLANEOUS	C.P. INVERTEBRATE ZOOLOGY (7:00)	← CONTRIBUTED PAPERS →		
					← C.P. DEVELOPMENTAL BIOLOGY →					← C.P. DEVELOPMENTAL BIOLOGY →			
					← C.P. COMPARATIVE PHYSIOLOGY →								
						COMPARATIVE PHYSIOLOGY (7:30)			MORPHOGENESIS		INTERSTITIAL FAUNA		
					← TERRESTRIAL ADAPTATIONS IN CRUSTACEA →								
									← C.P. VERTEBRATE MORPHOLOGY →				
									← C.P. COMPARATIVE ENDOCRINOLOGY →				
	ANIMAL BEHAVIOR SOCIETY	F3							← CONTRIBUTED PAPERS →				
								OPEN DISCUSSION (9:00)	RADIATION BEHAVIOR	OPEN DISCUSSION (8:00)			
	COMM. EXPERIMENTAL STUDY POPULATION	F4					DISCUSSION						
	ECOLOGICAL SOCIETY	F5			← PRODUCTIVITY AND MINERAL CYCLING → C.P. PLANT ECOLOGY (8:00)		C.P. PLANT ECOLOGY C.P. ECOLOGY (2:00)		← COASTAL MARINE ECOSYSTEM C.P. ECOLOGY →			ALLELOPATHY	
	HERPETOLOGISTS' LEAGUE	F6						CONTRIBUTED PAPERS					
	SOC. SYSTEMATIC ZOOLOGISTS	F7			← CONTRIBUTED PAPERS →		← ADAPTIVE RADIATION IN AQUATIC ANIMALS →		PROTEIN STRUCTURE	CONTRIBUTED PAPERS			
BOTANICAL SCIENCES	SECTION G TORREY BOTANICAL CLUB	G							W.C. STEERS, V.P. 1:30 AND MORPHOGENESIS				

ANTHROPOLOGY	SECTION H	H				A. SPOEHR, V.P. (4:30) CONTRIBUTED PAPERS							
					← INDIANS, ANTHROPOLOGISTS AND POVERTY →		OBSIDIAN STUDIES		← ENTREPRENEURSHIP IN CROSS-SOCIETAL PERSPECTIVE →				
PSYCHOLOGY	SECTION I	I							DISTURBED CHILDREN	ATTITUDE CHANGE (1:30)	L.J. POSTMAN, V.P. & TRANSFER, INTERFERENCE, FORGETTING	QUANTITATIVE METHODOLOGY (2:30)	
	AM. PSYCHOANALYTIC ASSOC	I1			← DEPRIVATION IN EARLY CHILDHOOD →								
	AM. SPEECH HEARING ASSOC	I2									SPEECH PATHOLOGY		
SOCIAL AND ECONOMIC SCIENCES	SECTION K	K				D. TRUMAN, V.P. (4:30)	POLITICAL DECISION MAKING		BIRTH CONTROL RESEARCH				
						INSTRUMENTS OF POLICY (1:30)			WORKSHOP				
	AM. SOC. CRIMINOLOGY	K1					← JUVENILE COURT PROJECT →						
	AM. SOCIOL. ASSOCIATION	K2										SOCIAL SCIENCES AS PUBLIC POLICY	
	METRIC. ASSOCIATION	K3									← INVITED PAPERS →		
	NATL. INST. SOCIAL BEHAVIORAL SCIENCE	K4						CONTRIBUTED PAPERS (1:30)					
	POPULATION ASSOCIATION	K5									← CONTRIBUTED PAPERS →		
	SOC. SCIENTIFIC STUDY OF RELIGION	K6			RELIGION AND ANTI-SEMITISM								
HISTORY AND PHILOSOPHY OF SCIENCE	SECTION L	L			PROBLEM OF STATISTICAL EXPLANATION	COMPARATIVE METHODOLOGY	STATISTICAL EXPLANATION IN PHYSICS				STATISTICAL EXPLANATION IN SOCIAL SCIENCES	P.J. CAWS, V.P. (12:00)	
	SOC. GENERAL SYSTEMS RESEARCH	L1	EDUCATION IN THE SEVENTIES	← ECOLOGY SOCIETY AND FUTURE →		COMP. METHODOLOGY		CONTRIBUTED PAPERS (2:30)	COMPARATIVE ADMINISTRATION SYSTEMS	GENERALISTS IN INDUSTRY	← METROPOLITAN AND REGIONAL PLANNING →		
ENGINEERING	SECTION M	M			← MAN AND TRANSPORTATION →								
MEDICAL SCIENCES	SECTION N	N							← MOLECULAR APPROACHES TO LEARNING AND MEMORY →		DELIVERY OF PERSONAL HEALTH SERVICES		
	AM. ASSOCIATION OF BIOANALYSTS	N1		INVITED PAPERS									
	AM. PSYCHIATRIC ASSOCIATION	N2					← PSYCHOCHEMICAL RESEARCH STRATEGIES IN MAN →						
DENTISTRY	SECTION Nd	Nd					← ADHESION IN BIOLOGICAL SYSTEMS →						
							L.R. CAHN (8:30) GLOBAL ORAL PATHOLOGY						
PHARMACEUTICAL SCIENCES	SECTION Np	Np							← C.P. HOSPITAL PHARMACY →		C.P. PHARMACEUTICALS	ABSORPTION AND DISTRIBUTION (2:00)	
										C. WALDON, V.P. (1:00) PHARMACY IN FED. PROGRAMS		J.L. GODDARD (1:00)	
AGRICULTURE	SECTION O	O			← EDUCATION FOR THE CRISES IN FOOD AND NATURAL RESOURCES →								
INDUSTRIAL SCIENCES	SECTION P	P					SYSTEMS ANALYSES OF THE CITY	E.A. JOHNSON, V.P. (12:00) OPERATIONS RESEARCH					
EDUCATION	SECTION Q	Q		INTERNATIONAL SCIENCE EDUCATION	H.A. SMITH, V.P. BENCHMARKS FOR SCIENCE EDUCATION	GROUP ACHIEVEMENT IN EDUCATION	RELATIONSHIP OF BASIC & APPLIED SCIENCE		TOWARD AN INTEGRATED MATHEMATICS				
	ALPHA EPSILON DELTA	Q1					CHANGING PATTERNS IN MEDICAL EDUCATION						
	AM. NATURE STUDY SOCIETY	Q2			C.P. ORIENTATION TO N.Y.		OPEN SPACE	LENSES ON NATURE (9:30)		RESOURCES AND YOUTH			
	AM. PHYSIOL. SOCIETY	Q3										PHYSIOLOGY IN COLLEGE	
	C.U.E.B.S.	Q							UNDERGRADUATE EDUCATION IN BIOLOGY				
	NATL. COUNCIL OF TEACHERS OF MATH.	Q5								EDUCATION IN MATH. SCIENCE			
	NATL. SCIENCE TEACHERS ASSOC.	Q6			COLLEGE SCIENCE TEACHING		ELEMENTARY SCIENCE TEACHING			SECONDARY SCHOOL SCIENCE			
	JOINT SCIENCE TEACHING SOC.	Q4				HUMAN ECOLOGY			EDUCATION FOR URBAN ENVIRONMENT				
	SCIENCE COURSES FOR BACCALAUREATE EDUCATION	Q7		INTEGRATED COURSE IN SCIENCE									
INFORMATION AND COMMUNICATION	SECTION T	T		PROCESSING OF PUBLICATIONS		ROLE OF MUSEUMS IN COMMUNICATIONS			GENESIS OF INFORMATION SYSTEMS	H. BENTLEY GLASS (12:30) P.V. PARKINS, V.P. (4:30)			
STATISTICS	SECTION U	U								G.E.P. BOX, V.P. (4:30)			
	BIOMETRIC SOCIETY	U1			← NUMBERS IN INSECT POPULATION →		KIDNEY TRANSPLANTS						
GENERAL SCIENCES	ACADEMY CONFERENCE	X1			AAAS-ACADEMY RELATIONSHIPS	YOUTH ACTIVITIES V.E. ANDERSON (6:00)	← AMERICAN JUNIOR ACADEMY →		← JUNIOR SCIENTIST ASSEMBLY →				
AAAS FILM THEATER					FOREIGN I	FOREIGN II	UNITED STATES	TRANSPORTATION	MARINE SCIENCE	MUMFORD ON THE CITY	75 YEARS OF FILM		

BOTANICAL SCIENCES (G)

Aspects of Morphogenesis 1967 (29 Dec.)

Arranged by William J. Crotty (New York University).

This symposium is the last in a series organized to celebrate the centennial of the Torrey Botanical Club and to commemorate the memory of John Torrey, a leading American botanist of the nineteenth century.

John Torrey was active in the formative years of many American scientific societies, including the forerunner of the present New York Academy of Sciences, and was listed among the "first fifty" incorporators of the National Academy of Sciences. It has been said that he found the meetings of the American Association for the Advancement of Science particularly congenial and he served as its president in 1855.

This symposium should serve to emphasize by means of rather specific contributions just how rapid the progress has been in the development of theoretical concepts and investigative techniques in the botanical sciences since the time of Torrey. The subject matter embraces problems of phylogeny, development, causal morphology and physiology. It comes as something of a shock to realize that many of the theoretical bases which the symposium speakers here take for granted were not even clearly formulated much less accepted when John Torrey's basic work in American systematic botany was fairly well completed.

Warren H. Wagner, William C. Steere, William J. Crotty, Dominic Basile, Edwin B. Matzke, Ulrich Naf, Myron C. Ledbetter, and Alberto Mancinelli.

ANTHROPOLOGY (H)

Anthropologists and Others (27 Dec.)

Arranged by Carol K. Rachlin and Alice Marriott (Southwestern Research Association, Oklahoma City).

The purpose of this symposium is to obtain some insight into the contributions of anthropology to applied fields (other than teaching) which can benefit from use of its data. The contemporary society of the United States offers many diverse opportunities to anthropologists. The acceptance of anthropologists in many of these fields has been less than the acceptance from scholars in other disciplines.

The fields of social work, religion, government, art, and literature will be represented on the program. All these fields can use anthropology and its students, yet few anthropologists are employed in them. Popovi Da, artist, San Ildefonso Pueblo, and Alice Marriott, writer and anthropologist, offer an instance where anthropology, literature, and art have come together.

The participants of this symposium will discuss the positive and negative aspects of anthropology in relation to their respective areas of endeavors. Problems of communication between anthropologists and others will be considered and solutions sought.

Carol K. Rachlin, Iola Taylor, Peter J. Powell, James Officer, Popovi Da, Alice Marriott, and Gene Weltfish.

Obsidian Studies in Archeology (28 Dec.)

Arranged by Joseph W. Michels (The Pennsylvania State University).

Obsidian is a lithic material with very desirable fracturing qualities which were recognized and exploited by prehistoric man for the production of tools, weapons, and ornaments in all parts of the world where obsidian outcroppings are to be found. Considerable attention is currently being focused on the archeological recovery of obsidian artifacts, and on the reexamination of previously excavated collections of obsidian artifacts, in response to the development of several new analytic approaches to the cultural interpretation of worked obsidian. The discovery of a technique by which each obsidian artifact may be accurately dated, quickly and inexpensively, has resulted in obsidian becoming a valuable resource in solving problems of site chronology. In addition, obsidian dating has proved to be a highly versatile tool for general archeological analysis by permitting the investigator to regard time as a known variable in the study of various aspects of an archeological site, and in the reconstruction of community activity. Application of radioactive trace element analysis to the problem of identifying quarry sources for worked obsidian is contributing valuable information on inter-community contact in general, and on trade networks in particular. When trace element analysis and hydration rim-dating are applied jointly to the study of obsidian collections, the collections become a significant source of culture historical information. The current interest in stone-flaking technology among archeologists has also contributed to interest in worked obsidian. Because of its glass-like composition, obsidian provides possibilities for observation of the scar phenomena resulting from stone-working activities not usually observable in flint or other chipped-stone materials. This observational clarity is contributing to the development of formal procedures for investigating percussion-flaking technology. The symposium highlights the growing application of the physical sciences to the study of archeology.

Clifford Evans, Irving Friedman, James B. Griffin, Gary A. Wright, William J. Mayer-Oakes, Joseph W. Michels, and Elizabeth K. Ralph.

Entrepreneurship in Cross-Societal Perspective (29–30 Dec.)

Arranged by Richard P. Schaedel (University of Texas).

Africa and Afro-American Parallels.

Latin America: Urban and Rural Aspects of Entrepreneurship.

Asia: Local and Trans-local Entrepreneurship.

Entrepreneurship for What?—Market vs. Antimarket Mentality.

The symposium is designed to bring into focus the concept of non-Western entrepreneurship and how it has functioned in economies of nonliterate peoples and so-called "underdeveloped" areas.

Substantive papers are to be presented from three major world areas: Latin America, Africa, and Asia. The purpose of the symposium is to relate the contributions of these papers to the current approaches in economic anthropological and economic theory. It is expected that certain par-

ticipants will concentrate on theory, others on data, and still others on case histories supporting or refuting hypotheses that have been advanced to date in economics and anthropology regarding the contexts and limitations of entrepreneurship, for example, entrepreneurship is meaningful only in terms of West European capitalism. Non-Western economic behavior and practices require other concepts; entrepreneurship is said to be nonexistent or to be performed by marginal "brokers" in nonliterate peasant subcultures because of indigenous or "pre-industrial" value systems or the operation of the principle of limited good. That type of entrepreneurship develops very sophisticated forms in non- and semi-literate lower class segments of society, in contrast to its weak elaboration among the elite, and reflects the assimilative character of "transitional" society.

The symposium is structured in such a way as to permit as much exchange among participants on cross-cultural cases as the occasion may warrant. It will be divided into three sessions, each of which will focus on a specific area. The fourth will have to do mainly with terminological problems, theory, the implications of entrepreneurship in the public domain, and the role of entrepreneurship in policy for accelerating socio-economic change.

John Middleton, Richard P. Schaedel, John Harris, Charles Frank, Marvin Miracle, and Gloria Marshall.

Manning Nash, Anthony Leeds, Tony Bonaparte, Calvin P. Blair, and Victor Goldkind.

Richard Lambert, Walter Neale, Arafin Siregar, and George Weightman.

Edward LeClair, George Dalton, Everett W. Hagan, Stefan Robock, and Warren Dean.

PSYCHOLOGY (I)

Transfer, Interference, and Forgetting (30 Dec.)

Arranged by Leo J. Postman (University of California, Berkeley).

The purpose of this symposium is to discuss current theoretical and experimental approaches to the analysis of transfer and interference in verbal learning. Since interference theory includes a widely applied interpretation of the forgetting process, the papers will be addressed to problems of both acquisition and of retention. A variety of theoretical positions and experimental programs will be represented.

Tulving's work centers on the role of subjective organization, that is, the structure imposed by the learner on the materials to be recalled. Ceraso's studies emphasize the sources of interference which come into play during tests of recall. Greeno's experiments are carried out within the framework of a mathematical model of the associative process. Martin's investigations are designed to specify the role of stimulus factors in transfer, as exemplified by the discrimination and recognition of stimuli in successive tasks. Keppel is concerned with the application of the principles of the two-factor theory of interference which attributes retention loss to the unlearning of old associations during the acquisition of new ones and the competition between available responses at the time of recall. Richardson is engaged in a systematic analysis of the component mechanisms of positive transfer, with special emphasis on the role of mediation. Postman's address will be directed at an evaluation of the present status of two-factor theory, and in particular current interpretations of the process of unlearning.

Murray Glanzer, Endel Tulving, Edwin Martin, James Greeno, John Ceraso, Geoffrey Keppel, Jack Richardson, and Leo J. Postman.

The Emotionally Disturbed Child in the Public School

Arranged by Dale B. Harris (Pennsylvania State University).

The problems of exceptional children have become particularly acute with the rapid expansion of the child population in the 1940's following a decade of depression in which attention was given to economy and to subsistence needs of people rather than to educational and welfare needs of special groups. Consequently, in the 50's, we found ourselves completely unprepared to handle the populations of children with special needs. A number of crash programs of education and welfare have been adopted. Many of these have been established at the federal level as a device for urging states to undertake their rightful responsibilities.

The emotionally disturbed child has recently become the object of such action. This category of children, long known to psychiatry and clinical psychology, poses several special problems when aids are devised for it through the agency of the public school. First, there is the problem of criteria for selection for special attention. In the second place, there exists no body of literature pertaining to special facilities, programs, and curricula for the education of these groups within the context of the educational institution. Such modes of "re-education" as exist have been developed principally within the psychiatrist's purview and the special facilities of the mental hygiene clinic. In the third place, because schools have been slow to pick up their responsibilities to this group, a wide variety of privately sponsored attempts have arisen to reeducate these children. Thus, the problem of certifying such agencies in the public interest exists as a significant one at the present time.

James Tomkins, Gabriel Simches, Shirley Cohen, Dale B. Harris, Wilbert W. Lewis, J. David Colfax, and Irving L. Allen.

Attitude Change: Recent Developments in Experimental Research

Arranged by Irving L. Janis (Yale University).

In the first talk, a series of recent experiments which were designed to test several explanatory hypotheses that might account for the conflicting results from prior experiments in forced compliance will be discussed. In these experiments, people are induced to play a role or to write essays in which they take a stand that goes counter to their own position. The new series of experiments specified the conditions under which the amount of monetary incentive will be positively or negatively related to the amount of attitude change.

The second talk will deal with a series of experiments that were stimulated by the discovery of an anomalous sequence effect: it was repeatedly found that in face-to-

face discussions, a person will end up having less esteem for a stranger if the stranger had shown signs of liking the person from the start than if he had shown signs of disliking him at first and then signs of liking him. Subsequent experiments indicated that under the latter conditions the stranger was more effective in persuading the subject to change his beliefs or judgments. Some studies to be reported attempt to determine the extent to which the anomalous phenomena can be explained by drive reduction, increased self-esteem and other mediating processes.

Individual differences in responsiveness to persuasive communications will be examined in the third talk from the standpoint of three psychological processes: (i) attention to the communication, (ii) comprehension of the message, and (iii) yielding tendencies that make for acceptance of the message.

The final talk will attempt to call attention to new approaches in experimental social psychology that may help to solve some basic problems in the field of attitude change. In this context, the implications of the three preceding talks will be highlighted and several other new lines of research cited.

Irving L. Janis, Barry Collins, Elliot Aronson, and William McGuire.

Quantitative Approaches to Classification in the Social Sciences (30 Dec.)

Arranged by Bert F. Green, Jr. (Carnegie-Mellon University, Pittsburgh).

The problem of discerning meaningful classes within populations is common to all the behavioral and social sciences. Standard quantitative methods of classification will be examined critically, and new computer-based techniques will be examined and discussed.

Bert F. Green, Jr., James M. Beshers, Neil W. Henry, Stephen C. Johnson, A. Kimball Romney, and Warren S. Torgerson.

Psychoanalytic Studies in Child Development: Biological and Social Deprivation in Early Childhood (27 Dec.)

Arranged by Albert J. Solnit (Child Study Center, Yale University).

Through the study of deviations evoked by social and biological deprivation, psychoanalysts refine their theoretical propositions and formulate new hypotheses. The investigation of "accidents" of nature and of society are compelling because of the human needs involved and because certain early psychological functions may be most clearly illuminated under such conditions. In this panel, four investigations reveal the range and continuum of such psychoanalytic studies in child development.

Albert J. Solnit, Sally Provence, Justin D. Call, Selma Fraiberg, Charles A. Malone and Reginald S. Lourie.

Speech Pathology: Some Principles Underlying Therapeutic Practices (30 Dec.)

Arranged by Arthur S. House (Purdue University).

Areas of study in which processes fundamental to human speech and language behavior are delineated. The processes—linguistic theory, language acquisition, respiratory physiology—are critical components in descriptions of speech language behavior, and as such should support the activities of speech pathologists that are aimed at the amelioration of disorders of speech and language. The areas will be presented in some detail and they will be discussed with an emphasis on determining the degree to which therapeutic practices are dependent upon underlying principles.

D. C. Spriestersbach, Paula Menyuk, Ronald S. Tikofsky, Harris Winitz, Edgar R. Garrett, James C. Hardy, and J. Douglas Noll.

SOCIAL AND ECONOMIC SCIENCES (K)

Science and Technology as Instruments of Policy (27 Dec.)

Arranged by Sanford A. Lakoff (State University of New York, Stony Brook).

Systems analysis is a tool to assist in making large scale decisions within a complex social setting. It has recently been embedded in a decision process called the Planning, Programming and Budgeting System (PPBS) for the non-military agencies of the federal government and for some state and local governments. The principal antecedents of both systems analysis and PPBS are in the design and operation of our military forces. The need for systems analysis in military applications arose from the displacement of directly relevant experience by the revolutionary post-World War II developments in military technology, by the accompanying increase in the importance, complexity, and cost of military equipment, and especially by the need to extend the planning horizon farther into the future.

Systems analysis was incorporated into an integrated planning, programming and budgeting process for the Defense Department under Secretary MacNamara in 1961. That process laid heavy emphasis on the explicit statement of alternatives and systematic comparisons among the costs and effectiveness of the alternatives as a basis for making choices among them. This basis has not replaced judgment in the process, but has strengthened and informed it. It has not replaced debate and bargaining in the process, but has focussed it and enabled it to converge on useful, rather than arbitrary, compromises.

There are important differences, as well as some similarities, in the reasons for applying systems analysis and the PPBS to the non-military agencies. Our society is undergoing important changes in both its goals and technology. Their effect has been largely to increase the importance and scale of collective decisions. This increase has created vitally important problems for government. First, our society still prefers individual choice wherever it leads to viable results. Second, unlike the competitive sectors of the private enterprise economy, government activities are not automatically subject to a selective process or discipline ensuring their efficiency. Third, public activities powerfully affect, for good or evil, the private sectors of our economy. It is the aim of PPBS to devise yardsticks to aid judgment about the goals and efficiency of government programs.

Sanford A. Lakoff, Fred S. Hoffman, Amitai Etzioni, Edward Friedland, Bruce L. R. Smith, and Albert Wohlstetter.

Science, Technology, and Political Decision Making (28 Dec.)

Arranged by Charles V. Kidd (Federal Council for Science and Technology, Washington, D.C.).

No problem of science policy has generated more theoretical issues than that of how to determine rationally how much ought to be invested in science and in technology, and how this investment ought to be divided among fields of science and among efforts to solve important problems. An equally difficult set of issues arises in the practical area: If one knew what to do, what structures and processes are best designed to secure effective action? Recent reductions and increases in the budgets of federal agencies accentuate the practical significance of the problems of choice, which involve a complex of technical, economic, social and political issues. The symposium will provide an opportunity to discuss the competition for resources among activities designed to reach economic, social and cultural goals, and the processes through which the competition is expressed.

Charles V. Kidd, Emmanuel Mesthene, Herbert Roback, Richard Nelson, and Christopher Wright.

Workshop on Science and Public Policy (29 Dec.)

Arranged by Eugene B. Skolnikoff (M.I.T.).

This session will be a general discussion, primarily among those concerned with developing university teaching and research in the area of science and public policy. A final detailed agenda will await further discussions at the meetings.

Research in Birth Control and Changing Sex Behavior (29 Dec.)

Arranged by Ailon Shiloh (University of Pittsburgh).

The purpose of this symposium is to present original research data concerning relationships between birth control and changing sex behavior. The symposium will highlight different theoretical and methodological approaches to the problem. Two senior authorities in this area of research will evaluate and discuss the papers and their implications. Audience questions and comments have been scheduled following each presented paper and the discussants.

Ailon Shiloh, Paul H. Gebhard, Ira L. Reiss, Frederick J. Ziegler, Mary Calderone, and Charles F. Westoff.

The Juvenile Court Project: Problems, Progress, and Prospects (28 Dec.)

Arranged by Donal E. J. MacNamara (John Jay College of Criminal Justice, City University of New York).

Short papers will be presented as the basis for evaluation and discussion by members of the project staff.

John Martin, Jacob Chwast, Stephen Schafer, John H. Noble, Vittorio Bonomo, James J. Sullivan, Edward Sagarin, and Canio Zarrilli.

Social Science as Public Policy (30 Dec.)

Arranged by Raymond W. Mack (Northwestern University and Russell Sage Foundation).

Four papers will address the question of what impact social science research has on policy. We shall look not only at the deliberate and intended application of social science findings in reaching policy decisions, but also at the unintended consequences of social science analysis and the dissemination of results on the data themselves and on the formation and implementation of public policy.

Participants will discuss the uses of social science in societal self-analysis and decision-making, some social consequences of research on education and on racial relations, and the reconstruction of social realities in developing areas.

Raymond W. Mack, Amitai Etzioni, Walter L. Wallace, Melvin M. Tumin, and Wendell Bell.

Invited Papers: Metric Association (30 Dec.)

Arranged by Douglas V. Frost (Dartmouth Medical School).

Fred J. Helgren, James F. Anderson, Frank L. Sheldon, Frank Y. Speight, and Joseph J. Urbancek.

Douglas V. Frost, John N. Howard, A. V. Astin and A. G. McNish, John Kincaid, Claiborne Pell, and Louis F. Sokol.

Population Trends (30 Dec.)

Arranged by Joseph A. Cavanaugh (Agency for International Development) and Dudley Kirk (Stanford University).

Parker Mauldin, Paul C. Glick, Stephanie Ventura, Norman B. Ryder, Raymond H. Porvin, Charles Westoff, Joseph A. Cavanaugh, R. T. Ravenholt, Moye Freymann, Robert G. Potter, Ronald Freedman, and Ansley Coale.

Religion and Anti-Semitism (27 Dec.)

Arranged by Marshall Sklare (Yeshiva University)

Speaker: Charles Y. Glock; Panel Discussion: Bernard Spilka, M. P. Strommen, J. J. Vaneko, and J. E. Dittes.

HISTORY AND PHILOSOPHY OF SCIENCE (L)

The Problem of Statistical Explanation (27 Dec.)

The scientific explanation of phenomena by their subscription under general laws is simple if the laws are universal, i.e. if the phenomena covered by them exhibit a uniform pattern. Unfortunately this very rarely happens; more often laws are statistical, i.e. the phenomena exhibit alternative patterns in more or less definite proportions, whether this means an occasional exception or a more nearly equal partition between cases. This raises a number of important philosophical issues, among them the following: (i) are there any genuinely universal laws, and if so are they to be regarded as limiting cases of statistical laws or as different in kind? (ii) is the inductive relation

between the law and the evidence on which it rests similar in the two cases, or are statistical laws to be established according to different principles, in particular perhaps according to a different interpretation of the concept of probability? (iii) does the explanation provided by statistical laws follow the pattern set by (ideal) universal laws, and make a similar contribution to our understanding of the world, or does it need to be regarded in quite a different (possibly more modest and pragmatic) light?

Arnold Koslow, Isaac Levi, Richard C. Jeffrey, and Wesley Salmon.

Comparative Methodology of the Physical and Social Sciences (27 Dec.)

One of the goals of general systems theory has been to identify common patterns in the structures and methods of different sciences. An obvious respect in which the physical and social sciences have resorted to common methods is in their use of statistical techniques. But it is not so obvious whether this represents more than a superficial similarity. Some of the questions which need to be raised and answered, therefore, include (i) whether in this (or in any other) respect the physical and social sciences exhibit a genuine methodological unity, (ii) whether the fact that in thermodynamics and particle physics the individual events covered by statistical laws cannot in general be observed individually, while in most social science situations the corresponding events in general can be, constitutes a radical difference between the two cases, and (iii) whether, and if so in what particular ways, statistical (or any other) techniques require special adaptation in the contexts of the different sciences (whether for example levels of significance taken as establishing causal relations in the social sciences might be considered inadequate for the same purpose in the physical sciences).

Richard Rudner, Sidney Morgenbesser, and William Sacksteder.

Statistical Explanation in Physics—the Copenhagen Interpretation (28 Dec.)

The chief philosophical puzzle posed by microphysics continues to be the theoretical status of the probabilistic or statistical measures which constitute its empirical foundation at the present time. The standard (Copenhagen) approach to the problem interprets these as measures of classical or "neo-classical" variables (mass, time, length, charge, spin) invoking the correspondence principle to bridge the gap between classical and quantum conditions, and considers the foundation so provided to be fundamental in principle. Various attempts, for example those involving "hidden variables," have been made to approach the problem in new ways, which would describe the physical state of affairs in non-classical terms. Apart from the difficult problem as to the nature of physical reality involved in this confrontation, it gives rise to an interesting question about statistical explanation, namely whether phenomena (as distinct from underlying states) which can be described *only* in statistical terms can nevertheless be explained in non-statistical ones, or whether in principle they require statistical explanation.

Albert E. Blumberg, Richard Schlegel, Arthur Komar, and Joseph Sneed.

Statistical Explanation in the Social Sciences (30 Dec.)

The social sciences, dealing as they do with populations whose members are individuals of a very high degree of complexity, must embody their results almost without exception in statistical laws, so that (unlike the physical sciences) their paradigm of explanation is statistical. They have in consequence been the source of numerous methodological innovations, some of which have acquired the status of theories in their own right (game theory, communication theory, etc.). Also scientific explanation itself is a phenomenon properly dealt with by the social sciences, to an analysis of which information theory, for example, is particularly relevant. Under the title of the symposium, therefore, two problems can be distinguished: (i) what forms do explanations in the social sciences in fact take (since they are virtually all statistical)? (ii) what light do the techniques of the social sciences throw on the nature of statistical explanation in whatever scientific context?

Stephen Spielman, Joseph Hanna, Roger Rosenkrantz, and Paul Diesing.

The Role of Systems Analysis in the Educational System of the Seventies (26 Dec.)

This session will feature the role of systems analysis in meeting educational challenges posed by the emerging technological and informational trends. It will explore ways to simplify, vitalize, and promote the systems approach to education. Emphasis will be placed on efforts to develop, utilize and finance curricula for all age groups in the educational programs of schools, colleges, business firms, and governmental agencies.

Jere W. Clark, Kenneth E. Boulding, Milton C. Marney, Bert J. Decker, and Carl E. Gregory.

Ecology, Society, and the Future (26–27 Dec.)

There are specific problems associated with human pressure on the natural environment. While each of these problems lies within the field of competence of a particular expert, their recommendations for the solution of a specific problem may conflict with the possibility of solving some other problems in the professional domain of other experts. In this sense, the simultaneous solutions to the spectrum of problems arising out of human population growth requires a systems approach in the richest meaning of the term.

Lawrence B. Slobodkin, Ruth Patrick, Kenneth E. F. Watt, John Wolfe, Phillip Ritterbush, and George White.

Comparative Administration and Management Systems (29 Dec.)

Recently, in the search for a "unified theory of management," "systems theory" and "general systems theory" have sparked new hope that at least a language suitable to explore the possibility may have been found. At this time, a new spirit of urgency is manifest. The toils of large-scale organizations embrace modern man ever more tightly and confront him with increasingly difficult and vexing problems. Modern technology has supplied cybernetically oriented computerized management information systems for more effectively coping with the new problems. A

major quest has become: How can we, with respect to any organizational problem, sufficiently take into account the "systems within systems within systems" reality?

Richard F. Ericson, Chadwick J. Haberstroh, Bertram M. Gross, Herman Berkman, W. H. McWinney, C. G. Lundberg, C. R. Dechert, and Raghu Nath.

Are Generalists Born or Educated—If Educated, for What? (29 Dec.)

Should there be undergraduate education in general systems to train people to be generalists? Can generalists be trained at junior levels? If so, what can they do with this training in industry? Considerable controversy exists. While many young persons and some academicians feel that general systems theory can and should be taught, many senior professional people question the validity and desirability of such training unless persons are also given a very strong and fundamental training in a specific discipline as well. Employment prospects will be discussed concerning these younger persons primarily interested in starting as generalists compared to those who will start in a specific direction.

Herbert Halbrecht, Elmer Doughtry, Walter Hahn, M. Mesorivic, and Milton D. Rubin.

General Systems and Urban Planning (30 Dec.)

Recent developments in systems analysis, decision-making tools, and computer technology have challenged traditional methods of urban planning and problem solving. This session is designed to appeal to both the analyst and the public administrator and to provide the opportunity for real dialogue between the two. The morning session will attempt a critical evaluation of what systems analysis can and cannot do in urban planning. Discussion will continue over lunch as participants join interest groups for round-table sharing of experiences and concerns. The afternoon session presents a review of systems analysis and new approaches in selected fields.

Albert H. Baugher, Harold W. Adams, William H. Mitchel, William L. Garrison, Charles P. Livermore, George Akahoshi, Martin Murphy, Robert N. Grosse, Stewart D. Marquis, Allen Feldt, and David F. Parker.

MEDICAL SCIENCES (N)

Molecular Approaches to Learning and Memory (29–30 Dec.)

Arranged by William L. Byrne (Duke University).

The availability of a variety of experimental techniques which can manipulate memory consolidation, enhancement as well as inhibition, have made it possible to propose definitive stages in memory storage. The nature of these stages in molecular terms is suggested by these techniques and by anatomical, chemical, and metabolic changes which are correlated with learning. Mechanistic proposals for learning focus on the apparent "prewired" nature of the nervous system and synaptic modification as a consequence of macromolecular synthesis. The synthetic capacity of synaptosomes can be evaluated, and the metathoracic ganglion of the cockroach is an experimental system for the study of nerve regeneration, a model for the differentiation of the nervous system.

The major emphasis of the second session will be an attempt to describe and evaluate the new controversial field of behavioral modification by injection of brain-derived materials, so-called "memory transfer." This evaluation will include a progress report on efforts to develop and test the reproducibility of specific procedures from several laboratories. The chemical nature of the active material(s) and a spectrum of psychological approaches will be described in individual presentations.

William L. Byrne, James McGaugh, Murray Jarvik, Samuel Barondes, Bernard W. Agranoff, John Zemp, Edward Bennett, Stanley Appel, Melvin J. Cohen, Robert McCleary, William Corning, Ejnar Fjerdingstad, George Ungar, Stanislav Reinis, and Frank Rosenblatt.

David Samuel, James V. McConnell, Harold Salive, Tsuyoshi Shigehisa, James A. Dyal, Arnold Golub, Otto Wolthuis, William B. Rucker, Ward C. Halstead, David Krech, Edward L. Bennett, Peter Ragan, and Walter B. Essman.

Some Current Issues in Psychochemical Research Strategies in Man (28–29 Dec.)

Arranged by Arnold J. Mandell (UCLA Center for the Health Sciences, Los Angeles).

After several decades of the use of various approaches to chemical studies of body fluids in psychological states in man in which research styles varied and "discoveries" have come and gone, it was thought that a conference devoted to stategy was both appropriate and timely. Has the failure to find very many significant and meaningful relationships been solely a function of the technical barrier of an inaccessible human brain, or has there been in addition some lack of clear thinking in the development of research approaches in this most difficult area?

A number of leading investigators who are proponents and users of various methodologies have agreed to come together to discuss the thinking behind their diverse approaches. Their data will constitute foci with which to elucidate the logic of their research strategies. It is hoped that the conference material will present explanations for past trends and perhaps generate new ones in research in this area.

Milton M. Cohen, W. Keith Selvey, Arthur Sawitsky, Arthur Siegelman, A. Friedhoff, A. J. Mandell, B. LaDu, G. Weber, M. Masuda, S. Eiduson, A. Yuwiler, G. Winokur, S. Kety, L. Sokoloff, D. X. Freedman, W. Dement, R. Kado and W. Ross Adey.

L. L. Judd, J. Durell, L. A. Gottschalk, J. Schildkraut, W. Bunney, E. Sacher, J. Mendelson, and M. Lipton.

Public Authority and Voluntary Initiative in the Delivery of Personal Health Services (30 Dec.)

Arranged by Gerard Piel (Publisher, *Scientific American*).

Public funds now underwrite the public undertaking that needed medical care shall not be denied to any person because he, individually, cannot pay the costs. The "consumers, arrangers, providers, and payers" in each community must now seek the rational organization of health services necessary to make optimum care available and accessible to all.

Gerard Piel, Lester Breslow, Lewis Thomas, and Kerr White.

DENTISTRY (Nd)

Adhesion in Biological Systems (28–29 Dec.)

Arranged by Richard S. Manly (Tufts University School of Dentistry).

Strong cohesive and adhesive bonds between cells are probably required for survival of land animals. These are properties needed in the fibers in a tendon and in the attachment between tendons and bones. Some marine organisms, such as barnacles, show abilities to form strong adhesive bonds. These bonds can be formed promptly under water to such inert surfaces as Teflon.

If the mechanism of biological adhesion could be applied by practitioners of the healing arts, there would be several benefits. Adhesives are being developed to fasten tissues together, and to bond tissues to organic and inorganic substances. Such properties are valuable to surgeons as substitutes for sutures, and to dentists for restoration of oral hard-tissue lesions.

The topic, "Adhesion in Biological Systems," was chosen to seek an interdisciplinary program that might cause sharing of knowledge about adhesion that is known only within unrelated disciplines. Certain scientists in physics, chemistry, zoology, botany, engineering, medical science, pharmacy, and dentistry, have special knowledge regarding adhesion, and others in these fields have an interest and a need to extend their understanding of mechanisms of adhesion. The emphasis on adhesion in biological systems may cause the scientists and engineers who have studied adhesion so thoroughly in nonbiological systems to become interested in the mechanism by which biological adhesion is so successful in the presence of moisture.

Three phases are involved in the cementation of one solid to another. The symposium begins with systems where all three phases are of biological origin, such as adhesion among cells in vivo and continues through the two biological phases, involving cementation of living tissues. Next follows systems where only one phase is of biological origin, such as in restorations to be cemented to teeth, or in adhesive bandages. The program also places emphasis on adhesion that takes place and remains effective in the presence of moisture. This again focuses attention on the mechanisms for adhesion which have meaning for the biological and clinical applications of adhesion.

There have been excellent symposia on the theory and action of adhesives commonly used for bonding surfaces of paper, wood, or metal. This program has scarcely any overlap with such symposia because of our emphasis on adhesion in the presence of moisture. This program is more concerned with the theories of adhesion, especially as they apply to biological systems, than with the nature of adhesives themselves. This avoids chance of the overlap with some excellent reviews that have been prepared on the more narrow field of adhesive dental restorations.

Barnet M. Levy, Lester R. Cahn, Leonard Weiss, A. Cecil Taylor, Robert Baier, Elaine Shafrin, W. Zisman, Sholom Perlman, Nathan F. Cardarelli, Charles E. Lane, and C. W. Cooper.

Peter M. Margetis, Fred Leonard, Surindar N. Bhaskar, Teruo Matsumoto, Ralph W. Phillips, Gilman N. Cyr, Ralph Heiser, James Chen, Henry L. Lee, John D. Galligan, and Anthony M. Schwartz.

PHARMACEUTICAL SCIENCES (Np)

Absorption, Distribution, Metabolism, and Excretion of Therapeutics (30 Dec.)

Lee H. MacDonald, William F. Bousquet, H. Patrick Fletcher, and John G. Wagner.

Section Np Distinguished Lecture (30 Dec.)

James L. Goddard, *Safety and Efficacy in Our Environment.*

AGRICULTURE (O)

Education for the Crises in Food and Natural Resources (27–29 Dec.)

Arranged by Richard E. Geyer (Commission on Education in Agriculture, National Research Council).

The Challenges Ahead.

Directions for Undergraduate and Graduate Programs in Agriculture and Natural Resources.

Education and Worldwide Agricultural Productivity.

Education and the Natural Resource Renewal, Use, and Preservation.

Improving Interinstitutional and Interdisciplinary Relationships.

The Future Role and Character of Technician Education Programs.

The crises in world food supply and in natural resource conservation continue to unfold. Whether major catastrophes can be averted may depend in large part on the education of future scientists, as well as the education of the technologists and technicians whose endeavors complement and supplement the scientists' efforts. Major long-range issues in higher education in agriculture and natural resources will be explored.

Russell E. Larson, George L. Mehren, Charles E. Palm, Thomas Ware, and Stephen C. Smith.

Richard H. Bohning, Franklin E. Eldridge, F. N. Andrews, Robert W. Hougas, and Keith McFarland.

N. C. Brady, Charles M. Hardin, Ralph W. Cummings, Leonard D. Baver, and Erven J. Long.

R. Keith Arnold, Carl H. Stoltenberg, Louis F. Twardzik, George Sprugel, and Norman A. Berg.

T. C. Byerly, E. J. Kersting, Nash N. Winstead, A. F. Isbell, Lester V. Manderscheid, and J. T. Clayton.

A. R. Hilst, Fred W. Manley, David H. Huntington, Seeber C. Tarbell, Melvin E. Jenkins, and H. Brooks James.

INDUSTRIAL SCIENCE (P)

Systems Analysis of the City (28 Dec.)

Arranged by Burton V. Dean (Case-Western Reserve University).

Operations research and systems analysis procedures have expanded their realms of applicability in the past decade from the earlier defense and industrial problems. The latest developments lie in applications to problems of local government.

This session reports on four important aspects of some of these problems. The first paper relates to the familiar problems of urban traffic systems. The second paper reports on a student project where instructional values were obtained from requiring students to design a completely new town in Boston harbor and to estimate the fiscal and engineering feasibility of its construction. The interesting keyword was "flexibility," in that it was a required ingredient of the plan. The third paper develops a management information system designed better to serve the city administrator's decision needs. Finally, the fourth paper addresses the crucial question of the role of the behavioral sciences in indicating preferred solutions to city problems—problems in which the human factor is so dominant.

W. Edward Cushen, Leslie C. Edie, Siegfried M. Breuning, David B. Hertz, Carter Bales, and Rosedith Sitgreaves.

Applications of Operations Research to Very Big Systems (28 Dec.)

Arranged by Ellis A. Johnson (American University, Washington, D.C.).

This session concerns itself with the many complex problems associated with the growing difficulties of nurturing new areas of operations research involving the organizational behavior of very large systems.

In systems involving the creative roles of many large future-applied aspects of the social sciences, there is greater need for development and use of many large hybrid systems. Deliberate creativity is required but multiple goals and objectives tend to be unpopular as well as difficult. This session seeks ways of solving the problem.

Ellis A. Johnson, W. L. Whitson, Russell L. Ackoff, and Joseph Becker.

EDUCATION (Q)

International Science Education (26 Dec.)

Arranged by Arthur Livermore (AAAS).

Dr. James DeRose, a consultant to the Science Teaching Center of the University of the Philippines, will report on the activities of the center in developing new science programs for elementary and secondary schools. Dr. Laurence E. Strong, formerly director of the UNESCO Pilot Project for Chemistry Teaching in Asia, will discuss the program that is being developed at Chulalonkorn University in Bangkok. Dr. Arthur Roe, Head of the Office of International Science Activities of NSF, will report on the summer institutes that have been held for the past four years in India. A view of international science education as seen from the vantage point of the Division of Science Teaching of the Department for the Advancement of Science of UNESCO will be given by Dr. Albert V. Baez. Dr. Baez has recently retired as Director of the Division of Science Teaching, a post which he held for 6 years.

Benchmarks for Science Education (27 Dec.)

Arranged by F. B. Dutton (Michigan State University).

F. B. Dutton, J. Darrell Barnard, Lee S. Shulman and H. A. Smith.

Measuring Group Achievement in Education (27 Dec.)

Arranged by Jack Merwin (Exploratory Committee on Assessing the Progress of Education, Minneapolis).

Achievement tests are developed to obtain reliable differences in levels of achievement of individuals. Summaries of scores for individuals from these tests have been, and likely will continue to be, one approach to measuring group achievement in education.

In recent years there has been recognition of the need to broaden our approach to group measurement. Three notable projects aimed at developing new procedures for measuring group achievement, one nationwide and two statewide, will be presented and discussed.

Lloyd N. Morrisett, Ralph W. Tyler, Jefferson Eastman, Paul Campbell, and J. Myron Atkin.

Relationship Between Basic and Applied Sciences Implication for Research and Development in Education (28 Dec.)

Arranged by J. Myron Atkin (University of Illinois, Urbana).

Mission-oriented agencies in education have the responsibility of improving school practices as rapidly as possible. At the same time, all those concerned with improvement of education must assure the existence of a scholarly and research base for innovations in the future. It is difficult to determine with certainty which research will have the most profound effect on practice.

There may be similarities between this broad problem and the basic/applied relationship in science, and the possible comparability will be examined in the symposium. Interrelations among federal agencies, universities, professional associations, regional laboratories, and industry as they affect research policy will also be discussed.

The recent availability of relatively large-scale funds for educational research and development activities requires examination of basic assumptions related to the most effective use of the public investment in education.

J. Myron Atkin, R. Louis Bright, and Richard Dershimer.

Toward an Integrated Mathematics-Science Curriculum in the Public Schools (29 Dec.)

Arranged by H. P. Bradley (Educational Development Center, Newton, Mass.).

The symposium will be a report of a conference held in Boston from 21 August to 8 September 1967, to discuss the interface between science and mathematics as taught in our schools and to propose changes which might lead to a better coordinated syllabus.

Andrew M. Gleason, Earle Lomon, A. S. Flexer, and Edward Begle.

Undergraduate Education in Biology (29 Dec.)

This symposium will consider the dual education responsibilities of biology departments: courses and curricula for biology majors, and courses and programs for non-science students.

The morning session will be devoted to a consideration of curricula for majors and a discussion of attempts to

narrow the gap between what is happening in the research laboratories and what is taught to undergraduate students. Curriculums that do not reflect the state of the discipline are grossly unfair to the student in terms of his being forced to expend much time and effort to make up deficiencies at a later date, and to the field of biology in terms of being deprived of a steady flow of adequately prepared teachers and researchers.

The afternoon session will consider the role of biology in the general education of students, chiefly those who at present are exposed to few (if any) science courses. In an age when science (and biology) has such a decided impact on everyday affairs, we can no longer afford a scientifically naive electorate.

Henry Koffler, Martin W. Schein, Clifford Grobstein, Jay Barton II, Donald S. Farner, Thomas S. Hall, Jeffrey J. W. Baker, and Carl P. Swanson.

Changing Patterns in Medical Education (29 Dec.)

Arranged by Maurice L. Moore (7 Brookside Circle, Bronxville, N.Y.).

The Alpha Epsilon Delta Symposium will present a program outlining the Changing Patterns in Medical Education anticipated in the next decade. The philosophical and pedagogical objectives of the medical curriculum in coping with the current medical knowledge explosion will be discussed with emphasis on the place of the curriculum in the overall training of the physician and the need of the curriculum to develop study and learning habits that will enable the student to continue his medical education throughout his professional life. The results of the current studies on the learning problems of medical students will be analyzed and evaluated. Representatives of three medical schools—one still in the developmental stage; another just getting under way; and the third a well established school—will review the innovations and changes under development in their curricula. An informal panel discussion will follow with the speakers answering questions from the audience. The symposium will be summarized with a critical appraisal of "Tomorrow's Medical School Applicant."

All persons interested in medical and premedical education and the preparation of students for a career in the health professions are invited and urged to attend this program.

Ralph D. Ascah, Edmund D. Pellegrino, Joseph S. Gonnella, Thomas R. Forbes, Richard J. Cross, George James, and George A. Perera.

Man and the Urban Society (27 Dec.)

Arranged by William B. Staff (University of Michigan).

Orientation to the New York City Environment.

Preservation and Utilization of Open Space.

Lenses on Nature.

Urban Environmental Resource Problems and Youth.

H. Seymour Fowler, Christopher Schuberth, Sam Yeaton, Emanuel Tobier, and Ron M. Linton.

Douglas E. Wade, Charles E. Little, William Roach, Hugh Davis, and George Pratt.

Verne N. Rockcastle.

Phyllis S. Busch, Edward A. Ames, Spencer W. Havlick, Martha Munzer, and Diana MacArthur.

The Role of Physiology in the Undergraduate Curriculum (30 Dec.)

Arranged by Grover C. Stephens (University of California, Irvine).

Developments in the field of physiology have been of overwhelming importance, both theoretical and practical, in shaping the development of biology in this century. The pace of these developments is such as to force continuing attention to the new way in which physiological information is coordinated with other topics to which students of biology should be exposed. Interesting and pressing matters of concern are raised by such facts as the tremendous proliferation of information in the various branches of physiology, a significant overlap of interests with such areas as biochemistry and biophysics and ultrastructure, and the increasing emphasis on quantitative approaches to biological problems at all levels of organization.

Grover C. Stephens, Donald S. Farner, H. Marguerite Webb, John A. Johnson, and William K. Stephenson.

Colloquium on Education in the Mathematical Sciences (29 Dec.)

Arranged by Marcia E. Weiser (Association of Teachers of Mathematics of New York City), Julius H. Hlavaty (Conference Board of the Mathematical Sciences), and George S. Cunningham (National Council of Teachers of Mathematics).

Roxee Joly, Carl B. Allendoerfer, Julius H. Hlavaty, Stanley J. Bezuszka, S.J., and Burt Kaufman.

College Science Teaching (27 Dec.)

Morris H. Shamos, Martin W. Schein, John Butler, and Walter Matulis.

Elementary Science Teaching (28 Dec.)

Harold E. Tannenbaum, Dean Ivey, Richard T. Codispoti, and Joseph Lipson.

Secondary School Science and a Liberal Education (29 Dec.)

Richard M. Harbeck, Robert Morgan, John Butler, and Albert F. Eiss.

Human Ecology and the Problem of Environmental Pollution (27 Dec.)

Robert W. Boenig, LaMont C. Cole, Ben Davidson, and Austin N. Heller.

Problem of Education in the Urban Environment (29 Dec.)

N. Sylvester King, Joseph C. Paige, Lawrence Hopp, and Robert Rosenthal.

An Integrated Course in Science Is Feasible (26 Dec.)

Arranged by V. L. Parsegian (Rensselaer Polytechnic Institute).

An Introduction to Natural Science (which includes

multidisciplinary, historical, philosophical features, and social implications of science) seems to have been achieved in the new course being developed and tried through support of the Charles F. Kettering Foundation. The course is for college students preparing for such fields as law, business, political science, art, teaching, theology, psychology, sociology, and anthropology.

V. L. Parsegian, Alan S. Meltzer, Paul R. Shilling, Abraham S. Luchins, and K. Scott Kinerson.

INFORMATION AND COMMUNICATIONS (T)

The Role of Museums in Modern Communications (27 Dec.)

Arranged by Ileen E. Stewart (National Institutes of Health).

Museums are moving into an era of diversification and automation. Their role in the nation and the community is changing rapidly as they attempt to serve many kinds of people in many new ways. Long a reservoir of priceless materials, their storehouse is now being shared in new and interesting ways with both laymen and scientists. Museums are gradually assuming a more dynamic role in the structure of higher education. Their importance as an adjunct to elementary education is increasing as they develop new ways to reach a larger percentage of the school children of the nation. In order to efficiently catalog, store and distribute the vast quantities of new materials that reach them daily, museums are employing the computer. This symposium will attempt to describe the changes that are taking place in the country's major museums and the hoped-for effects that these changes will have on public usage and education as well as on scientific advances.

Sidney R. Galler, James A. Oliver, H. Radclyffe Roberts, Herbert Friedman, and Donald F. Squires.

The Genesis of Information Systems: Hindsight and Foresight (29 Dec.)

Arranged by Ileen E. Stewart (National Institutes of Health).

Why and how do information services start? What pressures and what needs create the impetus and provide the resources to initiate new systems? How are needs incorporated into design? How are changing needs discovered and reflected in the system? Why have some services succeeded and others failed? These are the kinds of questions that this symposium will attempt to answer. Speakers will represent or discuss a variety of existing information services, one defunct service and two in the early stages of planning and/or implementation.

Richard L. Kenyon, Meyer Kessler, Joseph Caponio, Karl F. Heumann, Norman E. Cottrell, and Joseph Becker.

Roles in the Processing of Scientific and Technical Publications (26 Dec.)

Arranged by Ethaline H. Cortelyou (National Institutes of Health).

Ethaline H. Cortelyou, Samuel Katzoff, L. Dillwyn Eckhard, Mary Schaefer, Mary Killilea, and George S. Haskins.

Section T Luncheon Address (29 Dec.)

H. Bentley Glass, *"Pugwash" Interest in Communications.*

STATISTICS (U)

Estimating the Numbers in Insect Populations (27 Dec.)

Arranged by E. C. Pielou (Canada Department of Agriculture, Ottawa).

As the world's population grows the struggle between

Participating AAAS Committees, Sections, and Affiliated Societies

Committees: AAAS Committee on Arid Lands, AAAS Committee on Science in the Promotion of Human Welfare.

Sections: Mathematics, Physics, Chemistry, Astronomy, Geology and Geography, Zoological Sciences, Botanical Sciences, Anthropology, Psychology, Social and Economic Sciences, History and Philosophy of Science, Engineering, Medical Sciences, Dentistry, Pharmaceutical Sciences, Agriculture, Industrial Science, Education, Information and Communication, and Statistics.

Affiliated societies: Academy Conference, Alpha Epsilon Delta, American Association of Bioanalysts, American Association of Clinical Chemists, American Astronautical Society, American Educational Research Association, American Mathematical Society, American Meteorological Society, American Nature Study Society, American Physiological Society, American Psychiatric Association, American Psychoanalytic Association, American Society of Criminology, American Society of Naturalists, American Society of Zoologists, American Sociological Association, American Speech and Hearing Association, Animal Behavior Society, Association for Computing Machinery, Association of American Geographers, Biometric Society, Central Association of Science and Mathematics Teachers, Commission on Education in Agriculture and Natural Resources, Commission on Undergraduate Education in the Biological Sciences, Committee for the Experimental Study of Populations, Ecological Society of America, Herpetologists' League, Metric Association, National Association for Research in Science Teaching, National Association of Biology Teachers, National Council of Teachers of Mathematics, National Geographic Society, National Institute of Social and Behavioral Sciences, National Science Teachers Association, National Speleological Society, Paleontological Society, Phi Beta Kappa, Population Association of America, Science Courses for Baccalaureate Education, Scientific Research Society of America (RESA), Scientists' Institute for Public Information, Sigma Delta Epsilon, Society for General Systems Research, Society for Industrial and Applied Mathematics, Society for the Scientific Study of Religion, Society of Systematic Zoology, Society of Technical Writers and Publishers, The Society of the Sigma Xi, and Torrey Botanical Club.

men and pest insects for the available food and forest resources is becoming more intense, and more expensive. The success, or lack of it, of attempts at pest control cannot be judged unless one can estimate the number of pests in a given area. Only when these estimates can be made is it possible to judge how population sizes fluctuate, both naturally and as a result of human intervention. Many species of insect are involved; they vary widely in density; in the sort of environment they are found in; in motility; in their behavior at the different stages of their life histories; in the degree to which they are controlled by natural agencies; and in the damage they cause. Any particular population therefore presents its own peculiar problems. Taking the particular circumstances into account, the field worker has to devise a sampling scheme that is statistically sound, that gives the required precision, and that he can afford on his budget. There is thus great need for a thorough union of practical and theoretical knowledge.

E. C. Pielou, J. F. Wear, C. A. Miller, D. O. Greenbank, J. U. McGuire, Jr., L. P. Lefkovitch, F. B. Knight, D. M. Lee, R. C. Chapman, and G. M. Furnival.

Testing Compatibility for Kidney Transplants (28 Dec.)

Arranged by Max A. Woodbury (Duke University Medical Center).

Fritz H. Bach, S. J. Kilpatrick, Benjamin Barnes, and Max A. Woodbury.

GENERAL SCIENCE (X)

Academy Conference (27–28 Dec.)

AAAS–Academy Relationships (27 Dec.)
Youth Activities of the Academies (27 Dec.).
American Junior Academy of Science (28 Dec.).
Twenty-first Annual Junior Scientists' Assembly (28 Dec.).

AAAS SCIENCE FILM THEATRE

Arranged by Marlyn Lippard (AAAS Staff).
Note: Young people under sixteen are admitted to the Theatre only if accompanied by a registered adult.

Foreign Films I (27 Dec.)

Winter Guests (Les Studios Cinematographiques "Al. Sahia," Bucharest, Roumania).

The Nuclear Challenge (International Atomic Energy Agency, Vienna, with Kráthý Film, Prague, Czechoslovakia).

The Beautiful Land—The Geological Evolution of Japan (Tokyo Cinema Company, Inc.).

The 4th State of Matter (Comitato Nazionale per l'Energia Nucleare, Rome, Italy).

Catching of Fish by Poisoning the Water (Institut für den Wissenschaftlichen Film, Göttingen, West Germany).

The Metamorphosis of the Lepidoptera (Montello Film, Rome, Italy).

A New Realty (Statens Filmcentral and Laterna Films, Denmark, and Organization for Economic Cooperation and Development).

Foreign Films II (27 Dec.)

Crystallographers in Conference (Commonwealth Scientific and Industrial Research Organization, Australia).

Living Jewels (M. Guillon, France).

Low Reynolds Number Flow (National Committee for Fluid Mechanics Films and Educational Services Inc.).

In Pursuit of Cancer Cells (Tokyo Cinema Incorporated, Japan).

A Light in Nature (Petroleum Institute for the Royal Society, London).

Serpents of the China Sea (Laboratoire des Instituts Pasteur hors Metropole, Saigon).

United States Films (28 Dec.)

Legacy of Gemini (National Aeronautics and Space Administration).

Brookhaven Spectrum (Atomic Energy Commission's Brookhaven National Laboratory).

Secret of the White Cell (Prism Productions, Inc.).

Symmetry (Sturgis-Grant Productions).

LSD: Insight or Insanity? (Max Miller).

The Growing Edge (Empire Photosound Incorporated).

People and Particles: A Documentary Film of Physics Laboratory (Harvard Project Physics).

Introduction by Gerald Holton (Professor of Physics, Harvard University).

Films on Transportation (28 Dec.)

A Trip from Chicago (CBS News, Inc.).

Autos, Autos Everywhere (CBS News, Inc.).

Safety First-Second-Third (General Motors Corporation).

Dawn of an Industry (Derek Stuart for the British Petroleum Co., Ltd.).

United Aircraft Turbo-Train: A New Dimension in Rail Passenger Travel (United Aircraft Corporate Systems Center).

Horsepower and Hydrocarbons (State of California Motor Vehicle Pollution Control Board).

Noise: The New Pollutant (National Educational Television).

Films on Marine Science (29 Dec.)

The Earth Beneath the Sea (Lamont Geological Observatory of Columbia University).

Flying at the Bottom of the Sea (National Educational Television).

History, Layer by Layer (Lamont Geological Observatory of Columbia University).

Oceanography at Work (Willard Bascom).

Conquering the Sea (CBS News, Inc.).

A Fish-Eye View of Alligator Reef (National Geographic Society).

Illustrated Lecture by Walter A. Starck II (Institute of Marine Sciences, University of Miami).

Lewis Mumford On The City (29 Dec.)

The City, Heaven and Hell; The City, Cars or People; The City and Its Region; The Heart of the City; The City as Man's Home, and *The City and the Future.*

(National Film Board of Canada).

Seventy-Five Years of Scientific Films: 1890–1965 (30 Dec.)

A collection of unique historical films, some more than 70 years old, has been gathered from many countries for this special program illustrating the development of the scientific film.

Introductory remarks by Peter Morris (National Science Film Library, Canadian Film Institute).

Documents Filmés (Marey-Bull), France, 1891–1924.

Pond Life (Section), Britain, 1903.

Neu-Guinea (In Memoriam Dr. Rudolph Poch), Austria, 1904–1906.

Les Rayons Invisibles de Roentgen, France, 1912.

La Circulation du Sang, France, 1912.

Crystals: Their Making, Habits, and Beauty, U.S.A., 1914.

Battle of the Ants, Britain, 1922.

The Praying Mantis, Britain, 1927.

Einstein's Theory of Relativity, U.S.A., 1923.

The Cultivation of Living Tissue (Extract), Britain, 1923–1933.

L'Hippocampe, France, 1934.

In the Sands of Central Asia, U.S.S.R., 1942.

Embryonic Development—The Chick (Extract), Canada, 1953.

Cancer Cells (Extract), Japan, 1959.

Inflorescence, Czechoslovakia, 1966.

Ice skating at Rockefeller Center, midtown Manhattan. [Impact Photos, New York City]

See Science, *22 September 1967, for details about registration and hotel reservations for the AAAS Annual Meeting. Additional reports on events or symposia taking place during the AAAS Annual Meeting appear in the following issues of* Science: *22 September, "Evolution of the Earth's Atmosphere"; 29 September, "Terrestrial Adaptation in Crustacea"; 6 October, "Behavioral Research—New York Zoological Park"; 13 October, "Weather Modification"; 20 October, "Hazards of Iodine-131 Fallout in Utah"; 27 October, "New York Botanical Garden—Research and Education"; 3 November, "New York Aquarium and Osborn Laboratories of Marine Sciences"; 10 November, "Psychoanalytic Studies in Child Development" and "Adhesion in Biological Systems"; 17 November, "Lamont Geological Observatory" and "Marine Science"; 24 November, "Crime, Science, and Technology," "Molecular Approaches to Learning and Memory," and "Man and Transportation"; and 1 December, "Haskins Laboratories," "Web-Building Spiders," and "AAAS General and Sectional Symposia." Additional coverage about the meeting will appear in* Science, *15 December ("Boyce Thompson Institute," "AAAS Section Programs," and "Psychochemical Research Strategies in Man").*