This volume lists about 2,700 articles, some with annotations, selected from 50 English-language periodicals concerning science, technology, and public policy. Articles included were published between 1946 and 1967. The volume contains the following sections: Information Sources and Services; Philosophy of Science and Technology; Science; Government and Public Policy; Legal Aspects of Science and Technology; Education and Public Understanding of Science; Scientific and Technical Personnel; International Scientific and Technical Cooperation; Organization and Management of Research and Development; Science and Culture: Humanities, Ethics-Ethics; and Science and Society. Each section is subdivided so that related papers, or those dealing with a single geographic region are listed together under the principal headings. An introductory note outlines the problems of compilation, the criteria for selection, and the limitations of the bibliography. (AM)
PREFACE
To Volume II

This volume lists and where necessary annotates some 2,700 articles selected from 50 periodicals.* With some modifications in the sub-divisions of its contents, it continues the survey begun in Volume I of the literature on science, technology, and public policy published in English for the period 1945 through 1967.

As an aid to the users of this volume the editors have undertaken to restate the purposes of the bibliography, to indicate its emphases and its limitations, and to make clear what it does and does not purport to provide.

The bibliography represents an effort to provide, as rapidly and economically as possible, a survey of the more generally accessible literature in this emergent field of study. In attempting this, certain difficulties have been encountered that have influenced the outcome of the effort and of which users of the bibliography should be aware. Principal among these difficulties are: (1) the imprecise boundaries of the field of study; (2) the very large volume of relevant literature; (3) the widely scattered and diverse sources of the literature; (4) the intermixing of substantive or technical subject matter with policy-oriented content, which poses severe problems of selection and classification; (5) the large number of writings pertaining to issues or events of limited timeliness that are not significant in proportion to their volume as contributions to the literature of the field (e.g., United States visa policy for visiting foreign scientists); and (6) a not infrequent occurrence of multiple-publication of articles, sometimes under changed titles, in two or more journals, such as separate publication of the same article in England and in the United States. Before commenting briefly on these difficulties, which are inevitably also difficulties of the field of study, certain general observations about the effort should be made.

It has not been the purpose of the editors to produce a definitive bibliography of the field. To provide a definitive treatment limited to publications in English for the years 1945-67 would increase the size of the bibliography by at least half. The size might easily be doubled if relevant editorials and articles in news magazines and in popular journals were included. More importantly, the search for the less accessible or less apparent writings would require proportionately far more time than the survey of the more readily available sources represented in this work. The editors, supported by the National Science Foundation, have sought to provide a respectable coverage

*A list of journals and their abbreviations follows this preface and is repeated on pages 372-374 for the convenience of the reader.
of the literature that would have immediate practical utility. Judged by the response to its publication, Volume I has provided a much-needed aid to a new and rapidly developing field of study. A definitive bibliography in the literature of public policy for science and technology would be an improvement upon what could be made available within the constraints of time and money represented by this present effort. But were such a work to be attempted it would have to cover at least the same preparatory ground as the editors have already covered. Our efforts have been those that would first have to be taken to achieve this more elaborate and more costly goal. We have done what the circumstances seem to require and permit, but would be happy to see others continue the effort toward a more comprehensive work.

Among specific bibliographical problems the imprecise boundaries of the field of study are most readily apparent. We have thought it best to err, if we must, on the side of breadth rather than in the direction of a more concise delimitation. The needs of users are varied, and for many of them the background data covered by Sections 2 through 4 will be useful. The history and philosophy of science and technology is a field of study distinct and apart from the study of public policy for science and technology. But the two areas of study are nevertheless related in important ways. Most importantly, the history and philosophy of science and technology affords an intellectual foundation for the study of science policy. We have therefore listed in Volumes I and II works in these fields that students of science policy might find useful. These citations are not necessarily those that all students of the history and philosophy of science and technology would select; they are not intended for reference by students in these fields who have recourse to more specialized bibliographical sources.

The large amount of relevant literature has placed a ceiling upon the number of journals that can be surveyed for a bibliography of specified size. The scattered and diverse sources of the literature add to difficulties of quantity. For the user it may be as important to know what the bibliography does not cover as it is to know what it contains. The only reliable way to provide assurance to the reader of what he is being offered seemed to be to limit the coverage to a specified number of journals, to survey them thoroughly, and not to include random articles from other sources unless the entire source could be surveyed for the period covered by the bibliography. This means, of course, that there will be relevant articles of high quality that will not be included in our listing. But the only systematic way to avoid this regrettable inevitability is to survey all periodicals—an impossible undertaking within the limiting circumstances of this work. There have been at least 150 journals in publication during the period covered by this bibliography that could yield articles of significance to the study of public policy for science and technology. In our selection of 50 journals we undertook to include the most abundant sources of relevant articles and also to cover the widest possible range of user interests—from engineering to esthetics.
The intermixing of substantive and technical subject-matter with policy-oriented content in writings related to science policy has created major difficulties of selection in both Volumes I and II. There are many books and articles that have important implications for science policy although they do not deal with policy matters directly. Should they be included? Most of them cannot be, for to include them would be to include a high percentage of all scientific and technical writing. A listing that included them would truly be encyclopedic. But how and where does one draw the line that separates substantive science from science policy? Probably no two editors would agree on all uncertain cases.

A final difficulty of selection pertains to those writings—often polemical—that burgeon around controversial but relatively short-term political issues. If the existing literature were to be listed in direct proportion to its volume, certain topics would heavily outweigh others, not because of intrinsic or long range importance, but because large numbers of people wrote voluminously about the topic at the time. Some of this literature must be included, but how much? Who decides what ultimate importance attaches to a given issue—the nuclear test ban treaty, for example, or international travel by scientists? The editors have tried to give priority to articles of continuing relevance over those largely limited in importance to a given place and time. They have also avoided extensive coverage of topics treated in detail in other bibliographies.

At the risk of redundancy, it may be useful to indicate more explicitly the basis upon which the items comprising Volume II have been selected. Selection has been the major task in the preparation of this volume. The amount of material greatly exceeded the space available. Criteria for selection were necessary. The editors were guided in their choices by a number of criteria that are stated as follows. With certain exceptions in which the great importance of an item overrode all other considerations, selections were made on the basis of the following tests:

1. No adequate or readily available bibliography already covered the subject-matter.

   In the interest of user convenience, important or representative items may be listed even in instances where specialized bibliographies are available. In Volume I, however, reference is made to the more specialized bibliographical sources.

2. The subject-matter of the item was sufficiently generalized, or sufficiently related to general issues or principles, to be of continuing interest and importance to the greater number of probable users.

   Certain issues of relatively limited continuing significance have been omitted or closely restricted. For example, United States visa policy for visiting scientists from abroad was the occasion for several years for numerous articles, editorials, and polemics. Retrospectively, the quantity of published writings on the
issue seemed to the editors to be disproportionate to its intrinsic importance. Accordingly, coverage on this subject is representative but by no means all inclusive.

(3) The amount of published material on the subject matter of the article was not so great as to require separate bibliographical treatment in order to provide comprehensive coverage.

Examples of science policy issues with an inordinately large literature are: the nuclear test ban, radioactive fallout, weapons systems policy, disarmament, the human population explosion, environmental pollution and world food production, and the "war on hunger." Many of the leading systematic books in these fields provide extensive reference to the periodical literature. To have listed all relevant articles on these topics in Volume II could have easily overbalanced the listings at the expense of other important items not nearly so well identified in other published sources.

(4) The article was signed or specific authorship was otherwise identified.

Unsigned articles, editorials, letters-to-the-editor, and news notes have rarely been included.

(5) The article is not merely a reprinting of another article already selected.

Where multiple publication or reprinting of an article has occurred, the editors have generally treated either the initial publication, or the one most generally available, as the principal item, have annotated it, and have merely referenced the other printings by journal and date.

Division of the volumes by books and by articles requires a person searching references on a particular subject--e.g. international scientific unions--to consult two or more volumes. But in many libraries periodicals are physically separated from other publications. In the library the user may therefore not be greatly inconvenienced by our separation of books from articles. To obtain an adequate assessment of the scope and coverage of any topic, both Volumes I and II must be consulted. This is especially so because, for many topics, the literature is not divided evenly between books and periodicals. New topics often appear in journals before they appear between the covers of a book.

For the period beginning January, 1968, a bibliographical bulletin issued by the Battelle Memorial Institute in Columbus, Ohio, has provided continuing coverage of the subject matter encompassed by this bibliography. This new publication fills a need for monitoring the growing literature in this field. Systematic bibliographical surveys are from now on indispensable to the growth and development of the study of the interactions of science, technology, and public policy. It would be desirable
for a regular, comprehensive bibliographical service to be undertaken on a continuing professionalized basis and to include publications in languages in addition to those in English. For this service, however, a long-term adequately funded institutional commitment would be required.
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SECTION I

INFORMATION SOURCES AND SERVICES

The articles cited in this section deal with problems of scientific communication and with systematic efforts to make available scientific and technical information. The articles range in coverage from general discussions of the difficulties of handling the growing volume of literature, to discussions of particular services or facilities for indexing, abstracting, and information gathering, storage, and retrieval. Several articles discuss information service activities of national or international governmental agencies. Other articles relevant to automated information processing systems may be found in section 4.2.


From the sociologist's viewpoint, science archives should include records which can give the historian insight into: (1) attitudes, values and opinions; (2) the decision-making process; and (3) the genesis, organization and development of professional scientific societies.


Suggests that laboratories—including industrial research laboratories—adopt a detailed archival policy so that administrative and other aspects of organizational history remain accessible to the historian.


Social and technological aspects.


A government-wide effort to give to the technical community of the U.S. optimum access to the quantitative data of physical science, critically evaluated and compiled for convenience.

Government bureaucracies and diplomatic red tape multiply complexities in foreign relations in science.


Indicates present scope and objectives of this research, which should result in improved methods of communication among scientists.


The federal government's responsibilities and ways in which they can be met.


Describes how chemical companies, universities, and public libraries step up exchange of computerized information.


Chemical Abstracts is one of the best mediums of national neighborliness because of its dissemination of chemical progress.


Describes work done by Office of Secretary of Defense and the joint technical activities of the Army, Navy and Air Force, as well as that of the AEC.


Other than published papers, the historian may be concerned with three categories of materials: personal letters, administrative records, and informal memoranda.


Describes the science collections and services of the Library of Congress.
GARFIELD, Eugene. "'Science Citation Index'--A New Dimension in Indexing," Science, CXLIV (May 8, 1964), 649-654.

Attempts to provide a perspective on the science-information or science "Indexing" problem and indicates importance of the Science Citation Index.


Publication in the U.S. and other countries, with special attention to problem of secrecy.


Kinds of information and methods of making them available by the AEC.


The OTS as a scientific and technical information service; advisory service to inventors.


Describes emerging design for a national system of handling scientific and technical information, and notes existing services such as abstracting and indexing services, government information services, and specialized centers.


Discusses three areas--government, academic and industrial--where there is an archival responsibility for the preservation of scientific records.


A new information center in Britain under the Department of Education and Science.

MEDLARS (Medical Literature Analysis and Retrieval System) at the National Library of Medicine is described and the man-machine relationships are discussed.


Comments on efforts to develop information systems and to study the interaction between the users of information and the information itself.


Plans for government involvement in a national scientific information service.

KRIDLER, Thomas and Gustavus SIMPSON. "Should Science Information be Centralized or Decentralized?" ABS, VIII (February, 1965), 29-33.

Compares scientific information services in the U.S. and the U.S.S.R.


Periodicals are the most important factor in the dissemination of new knowledge.


The goals and purposes of the organization and administration of archives preserving scientific material.


Summary of a report of the President's Science Advisory Committee. Discusses the responsibilities of the technical community and the government in the transfer of information.


OECD has undertaken an international program to encourage a network of specialist information centers for science and technology.

 Discusses the proposal of the Massachusetts Institute of Technology to establish an experimental base for the design of future information services.


 Discusses how new information technology can be effective if scientists give more care to their literature.


 Technical difficulties, paper shortages, and poor cultural relations are some of the difficulties in obtaining certain kinds of publications.


 The European Nuclear Energy Agency has inaugurated a Nuclear Computing Program Library and a Neutron Data Compilation Center as means for improving international information exchange.


 Reports on a London meeting of the Scientific Publications Council held on December 13, 1962, to discuss "Publication of Journals by Scientific Societies."


 Describes the needs fulfilled by the International Physics Activities at the American Institute of Physics, a central clearing house of information on physicists with international interests.


 The science collection and its broad reference service for readers.
Section I


Seven areas covering the relationship between the individual researcher and organized information services.


Establishment and services of Britain's new central library for science and technology.


Discusses the purposes of and demands for scientific information, the use of machines for handling the information explosion, and notes that these cannot substitute for the commitment of scientists to the work of collecting, indexing, reviewing and correlating information. (See also VICKERY, B. C. and D. J. SIMPSON, "Future of Scientific Communication," Sci Journal, II, No. 7 (July, 1966), 80-85, for views on the storage, retrieval, and future of scientific communication.)


The chairman of a special panel to study science, government, and information makes a number of suggestions for the storage and transfer of scientific information.


Describes the work of the Chemical-Biological Coordination Center of the National Research Council.
SECTION 2

PHILOSOPHY OF SCIENCE AND TECHNOLOGY

Writings from this field of study are included for the purpose of aiding the student of science policy to examine his subject against a background of at least minimal understanding of the meanings of "science" and "technology," their characteristics, conceptual assumptions, and place in man's intellectual history. This section does not purport to be a general bibliography of the philosophy of science or technology. It is limited to works believed to be most generally useful to persons who are not students of these subjects, but whose ability to understand public policy for science and technology would be enhanced by some familiarity with the theoretical foundations of scientific thought and method and the philosophical implications of technology. Additional and related materials on the sociological aspects of philosophy of science (2.3) may also be found in sections 7.1, 8.5, 11.2, 11.3, 12.1 and 12.2.

2.1 GENERAL


Argues for a distinction between technology and applied science on the grounds that science, both pure and applied, needs no corroboration as does technology.


"In the further enlargement of human knowledge and skills, there may be certain impossibilities which have nothing to do with technical competence but correspond to fundamental physical barriers."


In modern science the essential phenomena take place at the microscopic level, and direct actions on the human level no longer have their place in the introduction of theories and observations to science.


Examines observational and experimental techniques and the theoretical structure of the natural and the social sciences.

The definitions of science as "the method of verified hypotheses."


Seeks to show that philosophical dogma has no role in interpreting natural science, nor can such dogmas be culled from physics.


In neither physics nor metaphysics is it possible to see the world as a whole because there are valid and complementary images which do not apply simultaneously.


Analyzed the present fear and distrust of science as frustration at the failure of the logical, cause-and-effect, classical science.


Discusses aspects of the philosophy of technology.


"The relationship between science and the philosophical values of truth, goodness, and beauty."


Discusses the biological and social sciences and changes in concepts of the cause and the process of abstraction.


Three fundamental types of invariant relations in empirical science are discussed with freedom found only in determinism.
Philosophy of Science and Technology


The achievements of the last two centuries lie in a new attitude toward technology rather than in the progress of science.


Aspects of 19th century philosophies of science which influenced attitudes towards the Darwinian theory.


Discusses the relations between theory and practice, the potential applicability of pure science, and the cross-fertilization of applied science.

- "Technology as Skills," Tech Cult, VII (Summer, 1966), 318-328.

"A philosophy of activity."


The structure of physical science in its experimental, theoretical, and critical aspects.


The nature, divisions, and scope of science; its general limitations; and mental and social science.


Argues that scientists often have little formal training in scientific analysis because of the separation between science and the logic of science.

Stresses the problems of the social sciences which are different from those of the physical sciences.


"Changes in the foundations of modern science are an indication of profound transformations in the fundamentals of our existence, which... have their effects on all areas of human experience."


The basic importance of philosophy in science and the need for responsible interpretation.


"Benefits accrue from searching for the fundamental principles in individual technologies and for the relationships between them."


Criticizes the unplanned development of 20th century biology from the standpoint of John Dewey.

HULL, Clark L. "A Primary Social Science Law," Sci Mon, LXXI (October, 1950), 221-228.

To support the claim that the social sciences are true natural sciences, the author shows the law of stimulus generalization operating through a wide range of phenomena.


The history of the association of science and technology and current pressures for an even closer association.


Observations on the nature of science, development of a new science, and relations between sciences.


Considers the philosophical and social issues involved.


Without the introduction of science, technical achievement reaches a stage of perfection beyond which it cannot go.


Problems with space and time caused by the imperfections of our senses, and how we progress to overcome these obstacles.


Lack of lasting ideological basis for science has led to search for new religions and prophets or to skepticism.


Criticizes "scientific outlook" in social sciences as misleading and examines the effect of detachment in the social and biological sciences.


Both physical and social scientists "seek to sift the essential from the non-essential among the conditions which produce certain results".


Three models of scientific thought.

Scientific explanation is possible even when prediction is precluded, and Darwin's prediction must be amended to state "that if the struggle for existence continues, the forms of life will probably change."


Examines theories of the purpose of nature in terms of the theories of Lamarck and Darwin.


Argues for the distinction between science and technology based on the idea of technological progress and the complex structure of technology.


The pooling of new scientific knowledge has allowed for staggering advances in creative technology.


Describes the dichotomy between pure science with its refinement and exactness and the empiricism of human experience.


An argument against the idea that the present exponential growth of scientific research must slow down.


Considers the extent to which the social sciences can predict the behavior of man and concludes that moral values cannot be dispensed with.

Five imperfections of science and how they lend attraction to its study and how they can help bridge the gap between science and general learning.


Focus is the question: "Can a unifying concept from one field be applied in another?"


Presents general view of the similarities and differences between research in the natural sciences and in the social sciences.

2.2 SCIENTIFIC METHOD


Suggests a need to revive criticism as a part of the scientific attitude.


Importance of presuppositions in adding breadth to scientific investigation.


Discusses confusion which has arisen from operationalism's having been mistakenly regarded as a philosophic position.


Gives historical background of his conception of the operational stand.
Section 2


Describes the first step in testing an hypothesis—by experiment to discover factual evidence for or against it.


Mathematics offers a useful and exact language for sociological theory.


Analysis of the operationalist view of significant scientific concepts.


Discusses barriers to knowledge, parameters of research, the complexity of causal relationships, and the need for better communication between science and the citizenry.


Describes how it is possible to forecast in the very unlikely fields of biology and sociology by using the calculus of probability.

LAZARSFELD, Paul F. "Evidence and Inference in Social Research," Daedalus, LXXXVII (Fall, 1958), 99-130.

Problems connected with research in social situations.


Questions the validity of the operational point of view.


Attempts "to show that operational definitions occupy a critical role in the methodology of science".


Notes that scientific practice is more complex than "scientific method".


Scientific method arises out of practice and cannot be taught in the abstract.


Discusses the nature of scientific inquiry, the approaches to investigation, and the atmosphere necessary for scientific inquiry.


Discusses creative research in the biological sciences.


Some of the methods of science and the characteristics of scientists.


Science must be precise about value judgements in given inquiry and about decisions which ought to be made.


The interaction of mathematics with the life sciences (see also William G. COCHRAN, The Role of Mathematics in the Medical Sciences, p. 176).
SCHMIDT, Paul F.  "Some Merits and Misinterpretations of Scientific Method,"  

Redefines scientific method in order to show its scope and limitations.

SEEGER, Raymond J.  "Beyond Operationalism,"  Sci Mon, LXXIX (October, 1954),  
226-227.

Considers operationalism unproductive and intellectually dissatisfying.

2.3 SOCIOLOGICAL ASPECTS

ACKOFF, Russell L.  "Scientific Method and Social Science - East and West,"  
Sci Mon, LXXV (September, 1952), 155-160.

Comparison of Soviet and American social science shows that political influence  
has fettered and stunted the growth of both.

AUGER, Pierre.  "The Quality of Science: Knowledge and Action,"  Impact, VI  
(September, 1955), 123-130.

Considers various aspects of the connection between pure and applied science,  
emphasizing liaison, finances, and secrecy.

BAKER, John R. and A.G. TONSLEY.  "The Course of the Controversy on Freedom  

The Society for Freedom in Science was founded in Britain in 1940 to oppose  
the view that scientific research should be directed to economic ends, and  
directs its attention to investigating issues of freedom vs. organization in science.

(Summer, 1964), 455-476.

Presents views of the social factors influencing the progress of science in Europe.

BERNARD, Jessie.  "Can Science Transcend Culture?"  Sci Mon, LXXI (October,  
1950), 268-273.

The direction of scientific inquiry is culturally determined, but scientific method  
combats cultural bias.

How planners can use the method of science rather than just the facts of science to accomplish their goals.


Discusses barriers between science and technology, between various fields of the same, and between scientist and layman.


"The technologist is at the focal point of technical innovation, but he belongs to a separate system which is independent of both science and industry."


Distinguishes pure science as the search for understanding of nature and applied science as the manipulation of nature.


The science of science -- its tasks, organization of research, and practical benefits.


Discusses the extent to which the attitude of the experimenter and his mental image of the phenomena he studies affect the outcome of his experiment.


"An endeavor to clear away some of the stereotypes which stand in the way of harmony among various intellectual disciplines."

Describes the background of the present problems of nationalism vs. internationalism in science, basic vs. applied research, and specialization vs. coordination.


Aspects of the institutional framework in which social science research operates.


Contemporary science as a method, an institution, a factor in economic development, and a cultural influence.


The study of the organization, objectives, and development of science would include the economics of science, scientific manpower, the management of research, and national science policies.


An analysis of the relations between sociopolitical ideology, needs for scientific development, and independence of science in Nazi Germany and the Soviet Union.


Evaluates the theoretical and methodological adequacy of sociology as a scientific discipline to meet social problems posed by atomic energy and other technological advances.


Necessity and genius are not the primary factors in discovery; the pressures of accumulating knowledge make discovery inevitable.

Describes physics as invention, rather than discovery, and as open-ended and without ultimate truth.


Describes science as a social experience with four facets: culture, history, methodology, and rationale.


Republication of an article which appeared in the Polish journal ORGANON in 1936, setting up a scheme for the systematic study of philosophical, psychological, sociological, administrative, and historical aspects of science.


Shows that science cannot flourish when it is directed by the state or any outside authority, the corruption of genetic science in the U.S.S.R. being the most striking example. (For the opposite point of view and a discussion of the progress of Soviet genetics under government control, see KARTMAN, Lee, "Soviet Genetics and the 'Autonomy of Science'," ibid., LXI (July, 1945, 67-70.)


Scientific growth is based on the granting of independence to the individual scientist and the assessment of his contributions.


Advocates freedom and sharing of research.


Seeks a criterion for judging science, a theory for the science of science.

Discusses the dangers of misplaced emphasis on scientific method.


Contrasts the success of the application of scientific method in physics with its inapplicability to social and political problems.


Historical cases are offered in evidence for the argument that only in a climate of freedom can science progress rapidly.


Discusses effects of the Industrial revolution and the accompanying "cultural lag."


Discusses the importance of clinical research in medicine as a study of the whole man rather than just the parts.


Highlights crucial points at which relationships between revolutionary movements and scientific ideas can be demonstrated.


Discusses science as man's attempt to understand nature as we can control it.


Science needs not only adequate financial backing to flourish in an educated society and freedom for the satisfaction of curiosity...

Science is a source of basic knowledge, is related to technology, is vital to national defense, and contributes to the development of the reasoning mind.


Criticizes social scientists for avoiding critical issues, for oversimplification, and for their failure to investigate such important social phenomena as the space research effort.


The view that science is the product of cooperation for non-personal ends is a specific characteristic of the scientific spirit and of modern Western civilization.


A Soviet view of technology as the means of work within a system of social production and social life.
As with the preceding section, the published work listed here is cited by way of background for the study of public policy. The idea of a sequence of developments in time is essential to an understanding of the growth of science and technology and their impacts on society and government. Public policy that is not understood in its historical dimensions is not understood adequately. For related materials see section 5, which lists numerous articles describing the history of government-science relations in specific countries, and section 9, in which international cooperative programs and programs of international organizations are cited. A more comprehensive and continuing bibliography is printed annually in *Isis*, the journal of the History of Science Society.

### 3.1 HISTORY OF SCIENCE


Proposes that the study of the history of science be the integrating factor between science and the humanities.


Works resulting from U. S. expeditions, and European and American works on chemistry; physics; natural history; biology; mathematics; astronomy; and the history of science.


The development of science museums and of museum science through five centuries.

Section 3

The development of science as an autonomous facet of culture in Europe through the medieval and early modern eras and the social factors which contributed to it.


An historical sketch from the 1780's to the 1950's which explores the importance of the advance of science and its relation to government and industry.


Deals with European history of science from ancient times to the present and how science dealt with questions about nature.


In order to view it objectively, the history of science must be separated from the social conditions which accompanied it.


The past development of physical theory and its anticipated future development.


Relates several episodes, such as the confrontation between Thomas H. HUXLEY and Bishop WILBERFORCE, on the subject of evolution.

FOOTE, George A. "The Place of Science in the British Reform Movement, 1830-1850," Isis, XLII (October, 1951), 192-208.

Efforts within and outside government to reform and reorganize British science.

History of Science and Technology

This 14th century writer may be a genuine precursor of Montesquieu with regard to the theory of climatic influence on human groups.


(See comments by Benjamin NELSON pp. 612-616.)


Because the period of the greatest French scientific leadership coincided with the Revolution, considers the impact of the resultant social changes on the work and thought of the scientists.


History of chemistry, from its origins in alchemy to its early days as a "pure science," to its present function in improving the lot of mankind.


Scientists have become "soft" under the relatively lavish conditions in the modern laboratory, but it is not clear whether this helps or hurts science.


Historians can seldom pinpoint the exact time and place of a scientific discovery, and because discoveries demand readjustment, the process of discovery shows structure and extends in time.


Activities and publications of the French national scientific academy from 1666-1793.


"Modern scientific research implies a certain form of historical research as well," that is, the need to prove the novelty of a discovery.


The views of later writers on the rise of science and its effects during the Renaissance.

3.2 HISTORY OF TECHNOLOGY


The technology of some early civilizations affected their social and political development through the building of reservoirs, canals, and dikes.


Practical applications of radioactivity stemming from the Joliot-Curie discovery.


The ancient association of technology with the arts, its culminations in present-day automation, and the need to restore the human factors to the technological system.


Gives examples of the effects of taxes and duties on industrial technology in the British Isles from about 1750 to 1850.


How the shortage of timber in the British Isles, along with the demands from growing industries, led to new technologies such as the use of coal in the 16th century and afterwards. (See also the refutation of this thesis by FLINN, Michael W., "Timber and the Advance of Technology: A Reconsideration," ibid, June, 1959, 109-120.)

"How the Germans came to build it [rocket missile], what inspired them, how they succeeded, and especially why this weapon ... failed to become what its creators intended."


Urges the study of work, as well as of tools, processes, and products, to make the history of technology really useful.


Reviews research and observations of the supersonic movements of terrestrial objects.


The international exhibitions of the 19th century inspired the founding of technical museums, but emphasized the superficial and spectacular aspects of technology.


The historically independent developments of science and of technology and the importance of their intelligent applications to bring about economic and material progress today.


Discussion of some historical relations between science and industry.


Technology in history and the factors which influenced modern technological growth, such as the application of science to industry. (See also idem., "Historical Relations of Science and Technology," Nature, CC (December 21, 1963), i141-i145.)

A German atomic bomb project was psychologically and physically impossible because research was directed toward development of a prime mover rather than toward an explosive use.


From an unrivaled position in dyestuffs and pharmaceuticals, W. W. I aided in turning German technical and scientific prowess into channels of hate and destruction.


Role played by engineering in man's civilization and society from the ancient world to the present.


Account of the beginnings and establishment of the metric system, stressing the interactions of science, technology and social conditions.


The introduction of the metric system in France after the Revolution.


Survey of the relationships between scientists and technologists and their place in society.


Presents the necessity for viewing the history of technology against the background of cultural history.

Introduces new models based on the literature (science) and the state of the art (technology) to analyze the relations between them.


Few aspects of present day life are not beholden to the pioneers who discovered the nature, preservation, and augmentation of sight.


Early attempt to apply science to problems of industry and society. (For another description of the Lunar Society, see ROBINSON, Eric, "The Philosophers Who Met at the Full Moon," New Sci, XVIII (April 18, 1963), 158-160.)


The evolution of industrialization over nearly five centuries.

3.3 HISTORY OF SCIENCE AND TECHNOLOGY IN THE UNITED STATES


Changing interrelations among the social sciences during half a century.


Notes on the history of biology in America.


Many of the 19th century U. S. scientists were trained as physicians.

History of federal regulation, beginning with the problem of bursting steam-boat boilers in the early 19th century.


The sequence of events that led to the wartime atomic program, reasons for its success in the U.S., and future implications of its form of organization.


The influence of the Royal Society of London on colonial and post-revolutionary Americans.

FAIR, Gordon M. "Engineers and Engineering in the Massachusetts State Board of Health," NEJM, CCXXXII (April 19, 1945), 443-446.

An historical survey.

FULTON, John F. "The Impact of Science on American History," Isis, XLII (October, 1951), 176-191.

Case studies of the impact of science, primarily from medicine, since the 18th century.


Scientists of Jefferson's day "found their countrymen all too little interested in science. . . and labored as best they could to cultivate a taste for it among the educated classes. . . ."


Main directions of observation and inquiry, and the connection of these researches with conceptions of nature.
Discusses the first U.S. earth satellite program and its achievements.

Emphasizes the climate of opinion about the justification of public support for the surveys.

The reasons for the beneficial Quaker influence on the development of science.

KETTERING, Charles F. "Research Opens the Door," Sci Am, CLXXII (January, 1945), 7-12.
Discusses the changing pattern of U.S. research and invention since 1845.

The historical record of U.S. science and engineering has been second-rate compared to Europe. Warns that Russia might assume world leadership.

Discusses how the Civil War was influenced by chemists and chemistry. (Part 2. idem., "The Civil War," CEN, XXXIX (April 10, 1961), 116-123 for a continuation of the discussion.)

History, present organization of the museum, and its exhibits.

A study of the aims and practices of governmental funding for the survey.


Review of events from 1840-1848, when the American Association for the Advancement of Science was founded.


Describes experimentation with rockets before W.W.II.


The U.S. Air Force ballistic missile effort and its applications to space technology.


Examples of the place of technology in American life, the pragmatic approach, the relationship between technological development and Industrial application, and the role of technology in industrial organization.


History and description of the National Archives, with suggestions for use by historians of science.


An explanation of why two federal organizations, created early in 1863 to provide scientific advice and aid, accomplished so little of either during the Civil War.


How the exploration and industrialization of the new nation led to advances in natural science and technology.

Describes the conception, theory, and calculations in the development of the hydrogen bomb.


Story of the exchange of information between British and American scientists which led to the Manhattan project and the development of the atomic bomb.


Establishment of the United States Coast and Geodetic Survey on February 10, 1807.


Contributions of the first U.S. missile systems to weapons development, space technology, and knowledge of the universe.


Franklin's writing on population growth, which was cited by Malthus, contained remarkably accurate forecasts of U.S. population.
SECTION 4

NATURE AND IMPACT OF SCIENCE AND TECHNOLOGY

The material cited here deals primarily with the social developments and public policy issues growing out of the application of science to human affairs. The organization of materials follows lines of contemporary research, in so far as they were represented in the journals surveyed. It does not represent the editors' arbitrary assignment of value to one field over another. Some of the more significant data on the impact of technology are obtainable only by implication in works on engineering, medicine, and public health which could not be included within the space limitations prescribed for this bibliography.

Section 4.2 includes items concerning computers, information theory, manpower aspects of automation, and human engineering.

Section 4.3 cites articles dealing with the conditions surrounding scientific discoveries and their implementation, and methods for predicting future states of science and technology with some degree of reliability.

Section 4.4 includes articles dealing with those technologies which tend to shrink "human space," i.e., communication and transportation. Several articles explore such policy implications of proposed supersonic aircraft as questions of social and economic need, developmental requirements, and potential environmental hazards which might result from their use.

Section 4.5 cites articles dealing with the impacts upon society of space exploration, including assessments of the so-called scientific and technological "spin-off" of space programs. Additional and related materials are cited in sections 5.2.1.4.8, 5.2.2.1, 5.2.6.3, 6.2.3, 9.3.2, and 9.3.4.

Section 4.6 contains citations of articles dealing with the nature and impact of various energy technologies in general, and of nuclear energy in particular. The large volume of literature on nuclear energy to be found in the selected journals covered in this bibliography, especially in the Bulletin of the Atomic Scientists, has made it unfeasible to list more than a small percentage of the published articles. Most of those included are concerned with peaceful uses of nuclear energy. The reader is directed to the ASB for coverage of such issues as the question of civilian versus military control of nuclear energy in the United States, the nuclear test ban treaty discussions, and the controversial questions of civil defense preparations for
nuclear war. Scientist and Citizen (Environment, after January 1, 1969) is also recommended for further information in the above areas. Additional and related materials may be found in section 5, and particularly in 5.2.1.4.1, 5.2.2.5, and 5.2.6.3. Legal aspects of nuclear energy are cited in section 6.2.4, and European cooperative efforts in nuclear energy development are cited in section 9.3.2.

Many of the articles cited in section 4.7 are concerned with two major aspects of man’s uses of science and technology in relation to his environment: uses of science and technology to increase or stretch food and other resources; and relatively new perspectives of the impact of the use of technology on the environment, particularly in view of the rapidly increasing stresses upon the environment resulting from the population and technology explosions. Additional and related materials will be found in section 6.2, which explores some of the legal problems of international rivalry or cooperation in the use of resources; and in section 6.6, which deals more specifically with legal aspects of environmental control. Articles dealing with suggested benefits and problems of technological development will be found in section 5.2.10. Related items will be found under section 9, dealing with international scientific and technological cooperation. Articles dealing with general perspectives on the uses of science and technology for human purposes will be found in section 12.1.

Section 4.8 cites articles dealing with the development of biomedical sciences and technologies, their relevance to other scientific disciplines, and their impact on society. Additional and related articles will be found under national headings in section 5, e.g., 5.2.1.4.2, where governmental policy or the role of governmental agencies has been prominent. Legal aspects of biomedical sciences have been dealt with in sections 6.3 and 6.4, and some of the ethical problems of biomedical experiments are discussed in section 11.2. International cooperative programs concerned with biomedical sciences will be found in section 9. Some additional items are included under section 10.

In section 4.9, the impacts of developments in psychology, biological sciences, information theory, and automation on educational philosophies and practices are discussed. Additional and related materials will be found in sections 4.2, 7.1, 8.2, and 8.4.


Believes that, beginning in the 18th century, man embarked on the "Scientific Age," and describes the significance of science in life today.


The need for adapting technological innovations to law enforcement operations.
Nature and Impact of Science and Technology


Considers "the organization and financing of pure and applied research in a free society, and the implications of such arrangements for industry and medicine."


Effects of technological change on society and the costs to be paid.


A study of the great irrigation civilizations of ancient Egypt and Asia indicates that technological revolutions create a need for social and political innovations.


The changing relationship between physics and the economy and the new roles of the physicist and the research director.

EBERHARD, John P. "Technology for the City," TST, LVII (September, 1966), 18-29.

A systems approach to the building of cities to reconcile technology and human values, including the role of the federal government.


The nature of technology, its indispensability to science and other fields, and the need for understanding the proper uses of technology and determining to what needs it shall be applied.


Shows "how the materials technologies interact with other technologies in use, and in the methods used to process materials."

The various facets of this impact which the author believes gives rise to the need for a common culture.


Utilization of engineering skills will help the U.S. conserve scarce natural resources and reduce production costs.


Maintains that operational research has developed over several decades and outlines the influence it can have on future social development.


Some of the principles of radiocarbon use and the contributions they can be expected to make towards the progress of mankind.


Outlines the prospects and challenges to be met by science.


Changing methods and Increasing influence of science, the need for more fundamental research, and dangers posed by the advancement of science.


The state of mankind after ten years of atomic energy and speculation on the future picture.


Case histories illustrating the complex interrelations between technological and social variables.
Nature and Impact of Science and Technology


The use of aerospace problem-solving methods to solve socioeconomic problems.


A biophysicist stresses the need for prediction of the social effects of scientific advance, using molecular biology as an example.


"The long-term objective of the engineer must be to invent machines which contribute to the increase of human happiness."


A discussion of the nature and functions of technology and its effects upon society.

4.2 AUTOMATION AND CYBERNETICS


The social and economic effects of automation and the need to consider the human aspects of the changes it brings.


An assessment of the impact of automation on job content and structure and suggested guidelines for a manpower policy.


Nation-wide computer networks will provide the user with immediate access to a wide range of computer facilities.

A plea for more scientific and technical training facilities in England and a greater role for planning technological developments.


Studies of the impact of computers and automation on society have not been scientific.


Effects of automation on commerce, on management, and on labor.


The automation revolution is about to begin, and mass communications will be responsible for spreading it world-wide.


The application of cybernetics to studies in social science and psychology, and the need to establish definitions that can integrate disciplines.


Positive and negative potentialities of the increasing amount of leisure.


Automation involves not only technological, but social change, which must be faced by both the private and the public sectors.


Good and bad effects of automation on employment and suggested steps for lessening resistance to it.

Automation in business calls for better-educated men who can adapt to rapid change.


The balance between science and leisure, science in opposition to leisure, and the increase of leisure in the neo-technical world. Biblio.


The impact of automation on the labor force and measures to solve the problem of unemployment.


Sees the computer as the most promising instrument for closing the gap between the scientist and the humanist.


Can technology, which has changed man's daily life for the better, promote man's well-being when automation has brought about an excess of leisure?


Shows how, as a material reality and source of wealth and a psychological reality and source of fear, automation can coalesce by the application of social science.


Unemployment, leisure, the changing role of government, fear of insecurity, conformity, and power and class formation.

What modern, general-purpose digital computers can be expected to do, how to control them, and current problems involved in their use.


Role of electronic computers in industry and business and an assessment of automation in manufacturing and management processes.


The effects of automation on employment, labor and business, the character of government, and the life of the individual.


Fourteen articles on the nature and impact of automation.


Conjectures about the economic and social impact of automation on the U.S. and the world.


The problems of using automation to bring about full employment and a universally higher standard of living rather than mass unemployment and shortages of skilled and professional people.


The applications of electronic computers and the social, economic, and educational problems involved.

The capabilities of computers and their impact upon society.


Automation calls for new kinds of employment which make possible applying technology towards realizing the best of human values.


Study of the impact of automation in a new power plant.


The impact of technology on production workers and some ways of employing those who will be displaced by automation.


The social and political implications of computer technology.


The effects of automation on the labor market and the need for several types of countermeasures to meet different types of unemployment.


Author explains the basics of automation and outlines the benefits and social evils accompanying this new technology.

Summary of an OECD Conference on automation which was intended as "an effort to lay the groundwork for sound introduction of automated processes."


Report of a conference on North American experiences. Includes excerpts from speeches by Thorkil KRISTENSEN, Willard WIRTH, and Allan J. MacEACHEN.


Resume of the findings of a survey on the impact of office automation on non-manual staff.


The future development, use, and impact of computers.


Papers from a symposium including: EDP: Implications for Public Administration by Lowell H. HATTERY; Policy Decisions and EDP Systems in the Federal Government by Frank W. REILLY; Introducing Continuous Change in Pennsylvania by Barton A. FIELDS; Building the EDP Future in New York State by Donald AXELROD; The Challenge of Obsolescence in New Orleans by Robert E. DEVELLE; The Metropolitan Data Center Projects by Robert L. WEGNER; and A Data Processing System for State and Local Governments by Edward F.R. HEARLE.


Held at UNESCO headquarters, June 15-20, 1959 to discuss the important place of electronic computers in science, technology, and Industry.

The prospects for automation releasing men from subhuman tasks are impressive, but must be accompanied by programs for retraining and the reorientation of attitudes.


Various kinds of calculating machines and their uses in science and administration.


Work done by W. Ross ASHBY and Frank ROSENBLATT in conceiving and constructing self-organizing systems -- automata. (See also FOGEL, Lawrence J., "Autonomous Automata," ibid., IV, No. 2 (February, 1962), 14-19, and PICARD, Robert G., "The Trend of the Revolution: Automation in the Laboratory," ibid., IV, No. 6 (June, 1962), 41-45, for discussions of the potential uses of automata.)


Automation in industry will free man from routine work, but this development depends on social and economic adaptation to the situation.


The effect of automation on employment; the skill and training required for a job; the quality of work; job satisfaction; working conditions; earnings; and organizational structure.


Three facets of automation: replacement of human physical strength; extension of human perception; extension and replacement of brain functions.

An address to the 12th Annual Joint Engineering Management Conference showing the relationship of automation to private and to public enterprise.


Results of a survey of scientists' attitudes toward the computer.


A labor union official's views of automation. (See also idem., "End or a New Day in Unionism?", Annals, CCCL (November, 1963), 25-35, for a review of the problems presented to unionism by automation and the changes it will bring.)


"Human Rights in a Cybernated Age," Ed Rec, XLV (Spring, 1964), 113-121.

Essential human rights in a "cybernated" age include an assured income, development of full intellectual potential, and meaningful work.


Causes of the fluctuation of economic quantities, and the close analogy existing between economic models and certain physical systems that depend on the principle of feedback.
Nature and Impact of Science and Technology


Cybernetics has changed the structure of society by giving man fuller control over nature and leaving him with the problem of adapting himself to the new environment he has created.


The stages of data processing, its use in the Connecticut state government, and its impact on organization and administration.


Computer simulation studies are especially suited to problems of systems management in such fields as agriculture, wildlife management, and epidemiology.


Science is now the decisive productive force creating tools which will bring about production without machinery and leave man merely to design, manufacture, and improve automatic systems in chemical - mechanical technology.

4.3 INNOVATION AND TECHNOLOGICAL FORECASTING


Case histories illustrating the reluctance with which inventions have been accepted, and a plea for the encouragement of inventiveness.


Describes the emergence of the transistor as a product of its time and environment and indicates the lessons to be drawn from this experience.

The roles of government and industry in the support and performance of applied research should be better indicated in public policy. The functions of the universities in research are also discussed.


Reports on a meeting planned to bring scientists, industrialists, and investors to an understanding of their interconnected problems.


Methods and applications of technological forecasting, defined as "a prediction, with a level of confidence, of a technical achievement in a given time frame with a specified level of support."


Three aspects of the impact of science and technology on industry: improvements in technology, development of new products, and the introduction of such new managerial techniques as the computer.


Neither culture nor technology "inhibits the application of modern technology to the traditional crafts and pursuits," but rather the failure of technologists to apply their efforts to traditional work.


Shows "how new inventions and new techniques affect... the basic occupational and industrial structure of the nation."
Nature and Impact of Science and Technology


Summary of survey of technological forecasting as it is practiced or under development in 13 countries. (See also idem., "Forecasting the Future," Sci Journal, III, No. 10 (October, 1967), 40-45.)


The assumptions and methods used at the Hudson Institute for predicting the economic futures of societies are described.


The urgency of finding the most effective way to introduce "technical change without destroying cherished belief and patterns of life."


The director of the program sketches its plans and first projects. Its purpose is "to undertake an inquiry in depth into the effects of rapid technological change on the economy, on public policies, and on the character of the society, as well as into the reciprocal effects of social change on the nature, dimension, and directions of scientific and technological development."

(See also idem., "An Experiment in Understanding: The Harvard Program Two Years After," Tech Cult, VII (Fall, 1966), 475-492.)


Describes how the new technology of microelectronics is affecting management.


Small firms supply a large percentage of the nation's inventive progress.


The social effects of production and use of inventions and the importance of predicting these effects.

Private firms should promote an active manpower policy to minimize problems of personnel adjustment.

"Technological Forecasting," OECD Observer, No. 27 (April, 1967), 33-34; 36.

The implementation of technological forecasting has enabled industry to establish meaningful goals for research.


The technological implementation of the results of scientific research must be encouraged by governments to promote economic and social progress.


Science affects man's material existence through technological innovation.


The impact of innovation upon a corporation and the reactions of those affected.

"Forecasting and Technological Forecasting," Daedalus, XCVI (Summer, 1967), 759-770.

Defines technological forecasting, outlines some of the obstacles to its effectiveness, and discusses attitudes about its feasibility and usefulness.


How technological research affects the economy and contributes to its growth and stability.
STAFFORD, Alfred B. "Is the Rate of Invention Declining?" AJS, LVII (May, 1952), 539-545.

The decline in the number of patents indicates new courses for invention in the future.


The challenge in predicting the future of materials is to see precisely their impact on "the materials system"; hence the author describes a "systems analysis" of the future of materials.


Like other technological innovations, atomic power may meet with strong resistances based on economic, social, and cultural factors.


Suggests a committee to identify "incipient social problems spawned by technological innovations," and to bring such problems to the attention of appropriate groups.


"The application of science to industry" and the effects on individual firms.


Examines impact of science and technology on management, concluding that management must adapt itself to their rapid change and progress.

4.4 COMMUNICATION AND TRANSPORTATION


Shows the technical feasibility of supersonic transport but warns that technology is not advanced enough to produce an SST economically useful to the airlines.

A forecast of the changes possible in transportation by the end of the century, the most important innovation being government legislation forcing transportation into harmony with its environment.


Environmental problems call for a unified theory of transportation to help identify "transport gaps" in which present vehicles are unsuitable.


The effect of noise on the community near a London airport and steps for Parliament to prevent the annoyance and possible danger of crashes in residential areas.


Human and economic geography and geo-political theories have been changed by air transport.


History of the film industry, an account of production and subject choice, and good and bad social impacts of films and the potential afforded by the cinema.


The impact of television and the need for more responsible consideration of its social effects.


"New government support for transportation R & D is spurring plans for integrating present subsystems, for using faster vehicles, and for developing radically new systems."


The important issues arising from the development of SST and the problems of the technological background. (See also idem., "Supersonic Transport," Sci Cit, VIII (April, 1966), 1-10, where SST as a commercial success or as a symbol of national prestige is considered.

Discussion of various unfavorable aspects of SST.


Noise is not generally harmful, but steps can be taken to reduce the annoyance from jets, other vehicles, and poorly designed buildings.


Communication satellites, their physical characteristics, low costs, uses, and demand.


Terrain and climate are the important factors discussed in water, railway, and air transport.


Eighteen articles on changing modes and means of transportation and the challenges they present to national policy.


Two study groups suggest sociological research into the effects of noise and of sonic booms.


The impact of the automobile on the economy and the way of life.


Prospects for using this means of transmitting telephone and television signals across the entire earth, which might be in operation within five years.

An analysis of the social implications of the sonic boom and ways in which its nuisance value can be minimized.


The promoters of the SST are influential people who are already beginning to feel the projects' benefits, whereas the projects' opponents can only argue on what they think will be its drawbacks.


The traditional orientation of U.S. policy on communications satellites and the need for a new outlook in domestic and in international communications.


Sonic booms and the need for national policy regarding overflight of supersonic airliners.


The growth and improvement of bridge building through the centuries, showing how bridges influence the expansion of cities and the prosperity of nations.


The use of satellites for broadcasting and the problems involved.


Stresses the importance of air travel for commercial and governmental activity and the potential benefits for international relations.


The problem of keeping objectionable sonic boom from ground level before supersonic transport can be put into regular service.
4.5 ASTRONAUTICS AND ASTRONOMY


The coming launching of Orbiting Astronomical Observatories is hailed by astronomers as it will overcome limitations placed on earthbound instruments.


The evolution of space research and a brief example of the uses made of such laboratories.


The current situation and predictions for the future.


Arguments for U.S. efforts to develop military offensive capability in space.

DRYDEN, Hugh L. "Future Exploration and Utilization of Outer Space," Techn Cult, II (Spring, 1961), 112-126.

An "assessment of the future of astronautics."


The technological benefits claimed by the U.S. space program which are not substantial enough to justify the vast amounts of money being spent.


Summary reports of the Working Group on Social, Economic and Political Implications from a summer study group to review problems in space research and policy.


The scientific benefits from space research and a caution against risking scientific progress by military or commercial exploitation of space activity.

Recent developments in Soviet and American space programs and potentialities for the European program.


The advances made in this field.


How the U.S. effort remains minimal despite early success, while the Soviet effort remains large despite early failures.


Recommendations of a committee of the International Council of Scientific Unions for the prevention of contamination of the moons and planets.


The possible uses of a satellite, such as measurements, cosmic rays, measuring the earth's magnetic field, ultraviolet light, meteorite bombardment.


The problems involved in a large government-sponsored scientific effort.


First of six articles on lunar exploration, giving practical reasons for lunar exploration. (Following articles by same author include "The Case for Going to the Moon," ibid., VI, No. 9 (October, 1964), 83-79, which envisages profitable manufacturing operations on the moon; "The Case for Mining the Moon," ibid., VI, No. 10 (November, 1964), 86-110, on the possibilities of profitable
mineral extraction from the moon; "The Case for Seeing the Universe," ibid., VI, No. 11 (December, 1954), 66-82, dealing with the unique opportunities for astronomical observations on the moon; "The Case for Life Beyond the Earth," ibid., VII, No. 1 (January, 1965), 64-80, which is concerned with the possibility of extraterrestrial life on the moon; and "The Case for Technological Transfer," ibid., VII, No. 3 (March, 1965), 67-87, which explains how and why science and engineering knowledge can be transferred profitably into the industrial and social sectors of present life.

SCHWARTZ, Leonard E. "Manned Orbiting Laboratory -- For War or Peace?" Int Aff, XLIII (January, 1967), 51-64.

Discusses Soviet and American programs for manned military space stations which were not prohibited by the treaty on peaceful uses of outer space.


Problems of the impact of space technology on politics, economics, and social and cultural life.


Describes the Anglo-French supersonic airliner project.


Motivations for the U.S. moon program, scientific objectives, and the probable course of the program.


Problems from the development of space communications and the interests of radio astronomy.


Discusses the Soviet Union's new sub-orbital missile and its implications.
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The research advantages of a satellite and the limits on design and behavior of the satellite are discussed.


Discusses the advantages to man to be derived from research in astronautics.

4.6 ENERGY

4.6.1 GENERAL


A Soviet scientist describes progress in the practical uses of solar energy.


Account of a conference held in Yugoslavia to consider power resources.


Chemists can contribute to the peace of the world by forestalling the too-rapid end of our fossil fuels and by furthering new sources of energy.


Begins with man's possession of fire and concludes with the prospect for world society and the satisfaction of all material needs through the use of energy.


Energy concept proposal to reduce pollution of air and water.
Nature and Impact of Science and Technology


Technical sessions of the Fourth World Power Conference which was concerned with energy resources and development.


The technical aspects of solar energy use and its future possibilities.


Discusses potential uses and developments of solar energy.


Policy decisions, resulting from the commercial availability of new types and sources of energy and the growing problems of pollution, will have to be made soon.


Since energy shortages will not be eliminated by the use of atomic power, the most energy possible must be obtained from all possible sources.


Estimates future world consumption of energy as compared with energy resources.

The scientific, moral, and philosophical problems of the power age.


"Each success in the field of energy represents a victory over the resistance offered by inanimate objects and over the obstacle of space; it thus concerns the geographer."


Discusses the conversion of solar energy into useful energy forms.

TIRASPOLSKY, W. "Energy as the Key to Social Evolution," *Impact*, III (Spring, 1952), 5-17.

The human race has passed through five stages in the mastery of the internal energies of matter subsequent to its exploitations of muscular and mechanical energy.


The use of solar and terrestrial energy can supplement conventional energy resources or substitute for them.


A culture becomes more highly developed as more energy is harnessed.

4.6.2 NUCLEAR


Believes nuclear power will bring about the destruction of mankind.

Many countries which are acquiring commercial nuclear power installations are also acquiring the wherewithal to make plutonium bombs.


Suggestions for a policy for energy development of underdeveloped nations, many of which have inadequate supplies of conventional power resources.


Presents several proposals for national policy concerning atomic energy development and control.


The importance of atomic energy for peaceful purposes, the value of international cooperation, and the many promising fields of application.


The risk element in developing atomic power is financial rather than biological, but the author believes it will be profitable.


The effects of atomic energy: world political structure to ensure peace; technological applications; and sociological effects.


Substance of an address covering the peaceful uses of atomic energy.


Sixteen articles on the subject.

Industrial applications of atomic power, medical uses, and international cooperation in atomic energy.


Project Plowshare and the advantages and disadvantages of nuclear excavation.


Discusses the role Industry must assume if atomic energy is to become competitive in the production of power.


By using atomic energy the productivity of industry can be greatly increased.


The atomic bomb as a dramatic manifestation of technological acceleration and the need for increasing cultural acceleration in other fields to avoid catastrophe.


Includes: Introduction by Pierre AUGER; The Future of Atomic Energy by John COCKCROFT; The Economic Aspects of Radio-Isotope Utilization by W.F. LIBBY; Radiation Exposure and the Uses of Radio-Isotopes by Lauriston S. TAYLOR; Isotopes and Radiation Energy In Industry by Henry SFLIGMAN; and The Significance of Atomic Energy for Food and Agriculture by R. A. SILOW.


A special report on Project Plowshare.
The findings of the Plowshare program, which was established to explore the feasibility of potential industrial and scientific uses of nuclear and thermonuclear explosions in various environments.


The Plowshare program of AEC is studying constructive uses of nuclear explosions, e.g., excavation of harbors, power production and mining.

JOHNSON, Gerald W. and Gary H. HIGGINS. "Useful Nuclear Explosives," S+T (IST), No. 38 (February, 1965), 54-60.

Progress made under the Atomic Energy Commission's Plowshare program to explore the usefulness of nuclear explosives as engineering tools.

LOMBARD, David B. "Plowshare: A Program for the Peaceful Uses of Nuclear Explosives," Phys Today, XIV (October, 1961), 24-34.

Possible use of nuclear explosives for excavation, mining, recovering petroleum, and control of water resources.


The interaction between the scientific achievements in atomic energy research and society.


Reprinted from ECONOMSTRIKA (no date given). Presents preliminary estimates of the economic importance of nuclear energy. Extensive bibliography.

The impact of atomic energy development upon political life and the need for physics and politics to be concerned with issues of human freedom, planning for peace-time development, and world government.


The teamwork between public and private investment, partly catalyzed by nuclear technology, has accelerated the industrial processes.


Discusses the implications for the future of civilian nuclear power of the Fermi reactor.


Recommends development policy in economic nuclear power for the United States and for Britain.


The destructive and constructive uses of atomic energy and the need for research to open up new possibilities.


How laboratories throughout the world are attempting to tame the reactions in which the nuclei of atoms are fused rather than split because this will provide an almost limitless source of energy.


A summary of the Cowles Commission study. Effects of producing energy compared to coal use in the iron and steel industry and household heating on investment, on backward areas, and on the international scene.

This project is part of the Plowshare program for the development of peaceful uses of nuclear explosions.


Discusses the hazards and benefits of radiation and urges a calm and rational attitude toward the inevitable use of atomic energy.


Discusses some of the frontiers in fields created by atomic energy development—medicine and biology, photosynthesis, and detecting pollution of water supply.


Processes involved in harnessing atomic energy and its uses in war and in peace.


Problems and prospects for nuclear excavation techniques, including test requirements for "clean" nuclear devices.


The promising uses of atomic energy in medical research and the civil defense aspects of medical service in atomic war.


Peacetime development of nuclear technology may, if properly developed politically, lower world tensions by de-emphasizing military aspects of nuclear energy.


The stimulating influences that the technical accomplishments of atomic energy have had on many branches of science.
Section 4

4.7 RESOURCES AND THE ENVIRONMENT

4.7.1 GENERAL


Abridged versions of three papers: Ecological Research and Farming, by E. M. NICHOLSON; The Natural and Artificial Control of Vertebrate Pests in Agriculture, by I. THOMAS; Insect Pest Balance in Agriculture, by A. H. STRICKLAND.


The symposium of the British Association discusses ways in which to make derelict land productive.


(Note especially Selected Bibliography on Environmental Knowledge and Planning, 31.)


Describes the gradual changes of "environmental decay" and suggests an approach to its control.


Biopolitics is the art of giving political answers to biological questions. Such political answers--wise or unwise--come about because biology does not always provide answers to the questions it raises.

... "Environment: A New Focus for Public Policy?" PAR, XXIII (September, 1963), 132-139.

Describes present principles and points of view for dealing with environmental policy decisions and suggests a more comprehensive approach.

The accelerating speed of environmental change indicates the need for applying ecological concepts. Analyzes obstacles to applied ecology.


The tools of systems theory are needed to cope creatively with present environmental crises.


The increasing number of environmental problems and measures which should be taken by scientists and by society to alleviate them.


Technological advance keeps creating new resources needed for an industrial society.


Aldabra, a small island in the Indian Ocean, is the cause of conflict between British-American plans for a defense post and the Royal Society's wishes to preserve it as a unique research laboratory.


The periodicity of locust swarms and possibilities of control.

A plea for scientists to speak out against the destruction of nature in our technological society and to exert more influence on public policy to protect nature.


The management of the environment involves choices which must be based on social, economic, and scientific considerations in a coordinated policy.


Examples of man's role in disturbing the balance of nature and the resulting destructive results.


MORISON, Robert S. "Education for Environmental Concerns," Daedalus, XCVI (Fall, 1967), 1210-1223.

Rationale for the need of new perspectives: how to make them part of educational programs.


Describes the effects of forest destruction on human society and the influence of forests on soil, climate, and water resources.


Twenty-four articles on conservation, mineral and energy resources, forests, soils, and water resources.

SEARS, Paul B. "Utopia and the Living Landscape," Daedalus, XCIV (Spring, 1965), 474-486.

Man's role is not to manipulate his environment but to adjust to it.
Nature and Impact of Science and Technology


Emphasizes the need for environmental studies of the optimum conditions for physical and mental activities.


Describes a project of the International Geographical Union to make a world-wide inventory of land use.


Activities of the NAS-NRC Division of Biology and Agriculture in the areas of conservation and natural resources.


Discusses how and why "each independent country will have to organize its own national research body to direct the study of the different aspects of its nature and natural resources."


4.7.2 POPULATION AND RESOURCES


Better utilization of crop and grazing lands and of resources from the sea will improve the outlook for an increased food supply.


The possibility that the world's material problems could be solved by the proper application of science and technology.


The U.S. can indefinitely continue its level of consumption and can bring to the underdeveloped countries the hope of supplying their human wants.
DARWIN, Charles. "Can Man Control His Numbers?" PBM, III (Winter, 1960), 252-263.

Predicts the possible trends in world population, birth control as official policy, and the new heredity over which man has control.


Surveys world population growth and its effect on economic development.


Thirteen articles on population growth, its control, and its effect on economic, technical, and social development.


The federal government must limit the U.S. population explosion and that of the rest of the world to avoid an inevitable famine in 25 years if the present population growth continues.


Political aspects of soil conservation and the need to educate the public.


An optimum population is relative to the chosen way of life.


Difficulties of attempting to control population growth and the growing pressure of population on resources in many parts of the world.


Includes a discussion of the population problem and a report on the discovery of oral contraceptives.


The relationship of population density to land resources and conclusions that the British population must be stabilized if it is to maintain its standard of living.


U.S. food shipments to Latin America and Asia have called dense aggregates into being in the port cities of those continents.


Chemical weapons are available to fight insect pests and fungi that destroy crops, but political considerations frequently prevent their effective use.


The social, economic, and environmental aspects of the food-population problems in the tropical world.


Discusses the technological aspects of increasing food production.


With more efficient industrial methods, utilization of photosynthesis opens up new possibilities for economic development.

Discusses the current crisis in population, natural resources, and the genetic dilemma which is caused by aid to the weak and inferior members of society.


A statistical study of technological progress in agriculture.


The effects of the mechanization of cotton production upon the South.


Human fertility, which is a key variable in projecting population growth, will determine the seriousness of future population crises according to the extent to which it is controllable.


Research in tropical agriculture has expanded considerably in this century; limited food production in Asia especially is now due more to economic than to technological factors.


World food production could be doubled by using fertilizers and other modern techniques.

ROSIN, Jacob. "Chemocracy, the Society of the Future," CEN, XXVIII (January 9, 1950), 97-98; 140.

Modern chemistry points the way toward utilization of natural resources and the creation of a world of practically absolute abundance.

Can Western science be effectively applied to increasing the agricultural output so that the growing population in Asia can be fed?


Considers land use, application of modern technology, social factors in nutrition, and training of farmers and specialists.


Oral contraception has become a major means of regulating fertility.


"Organic production by marine plankton algae is comparable to agricultural yields on land."


"The population problem is the basic factor in the development and utilization of the world's biological resources."


Use of electrical machines in agriculture and new applications of electricity.

SCRIMSHAW, Nevin S. "Food," Sci Am, CCIX (September, 1963), 73-80.

Discusses the ways in which science and technology can help solve the food problem.


Concludes that "there is no immediate prospect of radical new powers of controlling human heredity and evolution."

The service of science to agriculture and the importance of agriculture in the U.S.

4.7.3. MARINE SCIENCES


The greatest advances in nautical science were the discovery of nautical astronomy, the invention of Mercator's projection, and the invention of the marine chronometer.


Describes practical benefits from marine research and the UNESCO projects in this field.


Concludes that international regulations are not strict enough to prevent a reduction in the stock of whales.

ISAACS, John D. "Food from the Sea," IST, LXIV (April, 1967), 61-68.

More intelligent regulation of the fishing industry and incentives to inventiveness would help the industry to take advantage of U.S. fisheries research.


Future resource prospects from the sea include new methods of fish cultivation for food, thermal energy, and mineral wealth.


Includes 22 articles in the following categories: Introduction; National Agencies; Interest and Support; Research and Education; International Cooperation; Challenging Problems.

The resources of the sea are least exploited by those nations which need them most because of lack of skills and capital.


The ocean's resources include minerals, food, and navigation routes.


The ocean floor is strewn with nodules rich in manganese, copper, cobalt, and nickel, which might possibly be mined.


The resources of the sea and the problem of selecting points at which man can most advantageously break into the life cycle of the sea.


The science of oceanography and its applications.


Developments from Ptolemy to Mercator, systematic surveying, hydrographic advances, scientific chart making, timeliness of charts, and aids to safe navigation.


The training of "oceanographic engineers" capable of reaping the ocean's harvests will be the best long-run return from federal investment.
Section 4

Advocates Congressional support for oceanographic R & D based on analysis of potentially important resources of the sea and prospects for exploiting them.

4.7.4 ATMOSPHERIC SCIENCE AND WEATHER MODIFICATION

Present knowledge about changing the weather includes only slight modifications; changing the climate is far in the future.

The proposed Earth Resources Observation Satellite of the Department of the Interior.

Methods of predictions by different meteorological services and the importance of international cooperation in meteorology.

The air monitoring program in Chicago is described.

A questioning of the advisability of some man-made attempts to control the weather.

Possible modification of climates by engineering practices combined with climatological knowledge.

Project GHOST (Global Horizontal Sounding Technique) is the cheapest and most effective method of keeping a world-wide watch on the weather.


How the effect of the storm at Balaklava during the Crimean War brought the first governmental meteorological forecasting services into being.


The scientific developments that are transforming weather and some of their implications that transcend science.


Methods of equalizing uneven distribution of the resources of rain, wind, and warmth of the sun, which could be wasted.


In attacking the three main contributors to a Los Angeles-type smog, action on the sources emitting pollution is the most feasible.


Ways in which weather satellites have affected the science of meteorology.


The place of the Global Atmosphere Research Program in furthering knowledge of atmosphere and climate.

Evaluation of artificial earth satellites for meteorological purposes.


The failure of attempts at rain-making and an argument for repeating the experiments.

4.7.5 WATER RESOURCES


A major step in controlling the water of the Nile for irrigation and power production.


A symposium: Introduction by James W. FESLER; Congress and Water Resources by Arthur A. MAASS; National Executive Organization for Water Resources by Gilbert F. WHITE; The Valley Authority and Its Alternatives by Charles MCKINLEY; and Water Resources and American Federalism by Albert LEPAWSKY.


Reports by the Select Committee on National Water Resources with recommendations for use and control of resources.


A three-level government program for small watershed development.


The Committee on Water Resources Research coordinates all federal programs in this field with pollution control the area of major emphasis.


Describes research into improving the quality of brackish water or obtaining fresh water from the sea.


A national water policy is needed in Great Britain to deal with the problems of supply, pollution, and conservation.


Man has probably irreversibly disturbed the hydrological system, and pollution and distribution are the problems to face.


Management of groundwater is essential to conserve the supply and insure its freshness. Practices in Israel described.


Aspects of low and high cost water and such points as the ecological effect caused by the extraction of sea water.


Greater efficiency of use of water resources will be required as population and rate of industrialization grow.


Three aspects of water supply: purity; uniformity of quality; and volume required, and discussion of practices and progress in Britain.

"Three Instances of decision-making in a state water resource development agency."


Plans for combating waterlogging and salinity in West Pakistan.

"Water," ScI Am, CCIX (September, 1963), 93-108.

Development of water resources as a means of increasing agricultural or industrial production in the developing countries.


The need for more and better water can best be met by an interdisciplinary attack on utilization, renovation, and desalination.


Describes a river development scheme.


The application of research to determine the most efficient uses of water in arid zones and the social factors that influence use.

4.7.6 ENVIRONMENTAL POLLUTION


Some bio-chemical wastes cannot be broken down by microorganisms and may be forming harmful accumulations.
AUERBACH, C. "Biological Hazards of Nuclear and Other Radiations," Nature, CLXXVIII (September 1, 1956), 453-454.

Reviews official British and American reports.


Changing estimates of radioactive hazards and the overly-complacent government and public opinion.


The work of the Ontario Water Resources Commission.


Noise problems of modern life call for long-range planning and research into building and city planning.


Industry is both a cause and a victim of the pollution problem.


A discussion of the intensity of radiation from nuclear explosions, genetic effects, and radiation from nuclear power development.


Since the beginning of industrial development man has been creating a new environment harmful to all life.


Advocates action to control unrestricted rise of antibiotics in farming.


An inquiry into the pertinent aspects of the sociological problems of pesticides in the human environment.


Air pollution and the recommendations of the Commerce Department's Panel on Electrically Powered Vehicles.


Fourth report of the Aquatic Life Advisory Committee to the Ohio River Valley Sanitation Commission.


The pollution problem caused by the wreck of a British oil tanker has led to the search for new legislation and new technology to prevent such episodes in the future.


Activities of the Federal Water Pollution Control Administration.


The destructive effects of pollution in Lake Erie and some of the methods proposed to retard the natural aging process that has been so greatly accelerated by men's activity.


Recent scientific and political conferences have studied air pollution and helped increase public awareness of the problem.

An account, evaluation, and prognostication.


Discusses "the interaction of drinking water standards, stream water quality standards, and food standards."


Report to the International Symposium on Eutroplification (water pollution).


The problems of radioactive waste disposal and possible solutions.


Establishes criteria for national public air management for pollution purposes.


Los Angeles as an example of the causes and control of air pollution.


The use of pesticides in Britain and the need for stronger control by government to supplement the voluntary control measures taken by the manufacturers.


Problems in handling a common pollutant.

Report of the sixtieth annual meeting of the Air Pollution Control Association.


Agricultural and industrial wastes dumped into Lake Erie are accelerating its natural life cycle and making its extinction inevitable.


Contends that the fear of pesticides is exaggerated and will be detrimental to food production and public health.


Recommendations of a Radioactive Substances Bill in Britain which provides for a National Disposal Service for radioactive wastes.


The sporadic research undertaken since 1950 did not provide an adequate basis for tackling massive pollution in 1967.


Despite the high cost of achieving adequate water pollution control, the public is beginning to realize its necessity.


Analyzes the ecological problems caused by air pollution and suggests factors to be considered in planning its control.

British and American investigations of the effects of detergents on sewage disposal and river water.


An account of what is known about the effects of radiation exposure.


The pollution of the Mississippi River and the consequent pollution of fish.


Discusses technical, social, and political aspects of air pollution control, including the Clean Air Pact of 1963.


Life is recovering dramatically at this site of 59 nuclear tests.

WISE, William S. "Water Pollution Control," *CEN*, XXIX (December 3, 1951), 5120-5124.

The philosophy of pollution control, some of the difficulties involved, and the need for a coordinating agency.


Problems involved in combatting water pollution and the limitations of present efforts for river management.
4.8 BIOMEDICAL SCIENCE AND TECHNOLOGY


The abuses of medical science in Nazi Germany and the dangers of a utilitarian "rational" point of view in American medicine.


Ways in which the computer could be of use in the discovery and development of new drugs.


Fourteen articles on "the responsible exploration of the interrelationships between values and science in social medicine".


A view of biological radiation problems as they affect individuals and the making of public policy.


Describes a temporary screening clinic in Rotherham, England, which uses a production-line system and computerized records.


The sociological impact of how the biochemistry of drugs will modify behavior.

Conditioning criminals with a social conscience might be accomplished by drugs which aid such conditioning.


The facts of the Krebiozen promotion and methods for preventing future quackery.


Describes eugenics as a necessary human science to promote human well-being.

(For an opposite point of view, see ROBERTS, Catherine, "Some Reflections on Positive Eugenics," ibid., VII (Spring 1964), 297-307).


The benefits of medical research to humanity and the need for proper social control and use of its results.


Projects of the American Foundation, especially its fifteen-year study published as Medical Research: A Midcentury Survey.


The probable impact of biological knowledge on human affairs.

The reasons for, establishment of, and program purposes of a research bureau in federal-state weed research.


A review of the scientific activities of the American Medical Association.


Progress in human biochemistry to support the view that biological discoveries have greater influence on the family than do technological developments.


Ways by which expanding biomedical sciences may be applied.


All aspects of chemical warfare as developed at the present time.


The physical sciences have much to contribute to health science and other fields of biology in the way of organization, technology, and management.


The crosscurrents of change in the social order and in medical institutions and practice.


Theoretical and practical aspects of biology which affect the public good.


Several eugenic techniques and the extent to which they should be employed or are actually employed at present.


The history of progress in biomedical science and the requirements for advance today.


The support of biomedical science on a large scale in the U.S. directly applies to the alleviation of disease.


Ways in which technology can be deployed to reduce costs in the Health Service of Great Britain.
4.9 LEARNING AND EDUCATIONAL TECHNOLOGY


Man has adapted himself to scientific progress without loss to the life of the mind, but improved technology has created many thankless assembly-line jobs.

CARTER, Luther J. "Technology in the Schools: Educators are Uneasy," Science, CLIII (September 30, 1966), 1624-1626.


A historical review of mathematical information theory and cybernetics. Bibliography.


The impacts of technology upon education and a prediction of a life-long formal learning process in store for the general population.


"The achievements of research in the field of artificial intelligence".


Some of the principal theories and findings of research in the growth and meaning of technology in education.


The applications of technology in education.

Nature and Impact of Science and Technology


Future uses of communications and transportation technology and their possible influence on social and individual welfare.


A brief history of the machines, an explanation of the principles and procedures involved, and observations on the teacher's new role.


Compares Roman "programmed" instruction with our own and the printing press with the teaching machine.
SECTION 5

SCIENCE, GOVERNMENT, AND PUBLIC INSTITUTIONS

Much of the literature dealing with public policy for science and technology relates to the actions of specific governments, or to such useful conceptual groupings as "developing nations" or "Western Europe." Section 5.1 includes articles which treat the interactions between science and government in a general context; it also includes articles which treat some of these interactions comparatively, such as studies of research and development expenditures, or of science advisory structures in the United States and the U.S.S.R. Sections 5.1.2 and 5.1.3 illustrate two broad categories under which general studies of the interactions between science and government are often considered: education, research, and economic development; and science and international relations. Additional materials relevant to these categories will be found in sections 5.2.10.1, 6.2, 9.1, and 9.3.

Science in the United States, section 5.2.1, includes materials which have been subcategorized according to the classifications indicated in the Table of Contents. The reader should note, however, that many of the other sections throughout the bibliography are, in fact, oriented toward United States problems and perspectives. This situation results naturally from the fact that most of the journals surveyed draw heavily upon American authors, and also from the fact that most items dealing with the identifiable policies, problems, or institutions of other nations have been entered under national headings.

With two additional exceptions, most topics dealing with specific nations or groupings of nations are to be found under the appropriate headings of section 5. The exceptions derive from the increasingly international and cooperative nature of science policy in such geographically linked areas as Western Europe, from a similar linking of foreign affairs and technical assistance in the affairs of the developing nations. The science policy activities of Western European nations (5.2.1) may be found under section 9.3.2 when those activities are cooperative rather than merely national. Similarly, additional materials relevant to the new and developing nations (5.2.10) may be found under sections 5.1.2, 5.1.3, 5.2.1.5, 9.2.2, 9.2.3, and 9.3.3.
5.1 SCIENCE AS AN OBJECT OF PUBLIC POLICY

5.1.1 GENERAL


The consequences of the scientist's work must be interpreted to his fellow men and decisions on its use must be made by the community.


Scientists' knowledge as defense against gambling with the nation's future.


Ways in which government can best assist and stimulate technological progress in so far as it would add to man's happiness.


The problem of being scientific under the political control of scientific activities in the U.S.


A new scientific ideal in the late 19th century led to continuing conflicts with democratic assumptions.


Compares science policy in different countries.


The need for more study by political scientists of the field of science and public policy. Reviews: The Scientific Estate, by Don K. PRICE; The Moon-Doggle, by Amitai ETZIONI; and Ministers Talk About Science, by Emmanuel G. MESTHENE, ed.

Descarte's thoughts on the relation of science to humanity and the impediment the modern state offers to the applications of science to universal human needs.


Illustrates the need for statesmanship, education, and adequate communication to control and direct the rapid expansion of technology.


Using Britain as an example, describes the role and organization of science and states that government should finance and coordinate, but not direct science.


Reports on this conference, which was also supported by the Council of Europe and the Organization for Economic Cooperation and Development.


A first attempt at the international level to examine the problems of the development of social science research from the policy point of view.


Discusses reasons why governments should support fundamental research, problems of funding, organizations and environments conducive to high creativity, and proposals for the more rational use of the total resources of small countries.


The far-ranging impact of science on national policy has been recognized only gradually, and thus has been incorporated only piecemeal into the fabric of policy.

Research power and political strength are now mutually dependent.


Belief that government must not sponsor research just for practical, political, or prestige results, but also for scientific results.


The startling discontinuity between the academic man and the decision-maker in the science policy area and an interpretive reaction to it.


Reviews a report on Government and Allocation of Resources to Science by the Organization for Economic Cooperation and Development.


Describes the trend of the past decade when governments set up bodies of experts to advise on science policy.


The interdependence and similar objectives of science and politics are described.

Scientists are not necessarily best fitted to deal with science policy.


Science not only as a means of achieving goals, but as a "vehicle for redefining the ends themselves, modifying them, and making them more adequate to human purposes."


The importance of formulating an explicit national science policy, and summary of the major themes to be discussed at the first international meeting on science at the ministerial level.


Despite differences of structure, working methods, and ranges of influence in their respective countries, all councils have in common the aim to promote research.


Followed by a discussion on the relationships between science and government.


Summary of a report prepared for the Organization for Economic Cooperation and Development.


Sees the link between science and politics as the symbiotic relationship between the scientific spirit and the free society.


A summary of problems of science policy discussed at the meeting.

Science policy as a determinative of a nation's power and future.


The relationship between scientific method and policy-making.


Government support of pure and applied science would be more justified if the politically disinterested scientist and the scientifically ignorant politician cooperated in analyzing the basic effects of science on man's present and future.


Describes pure and applied science, showing that the former cannot generally be subjected to planning.

PRICE, Derek J. De Solla. "Nations Can Publish or Perish," St+T (IST), LXX (October, 1967), 84-90.

Published scientific papers provide a model for comparing the science programs of different nations as to scope, investment of resources, and effectiveness.

PRICE, Don K. "Organization of Science Here and Abroad," Science, CXXIX (March 20, 1959), 759-765.

The status and influence of the science adviser in the federal government, with comments on the role of his British counterpart.

Seminar discussions of science and public policy and the economy, fundamental and applied research and development, allocation of resources, and international scientific relations.


The challenge of whether the world can survive half rich and half poor.


Is the pattern of research in large and affluent countries suitable for small nations?


The failure to achieve international control of atomic energy and future plans, such as a Western defensive alliance.


Extracts from an address to the Science of Science Foundation on the subject of scientific advisory bodies.

5.1.2 EDUCATION, RESEARCH, AND ECONOMIC DEVELOPMENT


The connection between strong schools of science and engineering and regional development.


The effects of research and development upon the national economy and considerations for government policy concerning R & D.

Aspects of why the poor countries of the world are getting less poor very much more slowly than the rich countries are getting richer; the role of science and technology; and problems of population and industrialization.


Scientific activity and expenditure cannot continue to grow indefinitely and policies may have to be changed drastically when a slowdown comes.


History of development and factors creating "rich" and "poor" nations.


General education for all necessary for the developing countries.


"Input-output tables listing the transactions among all sectors of industry in the U.S. for the years 1947 and 1958."


A British view, proposing "an assessment of the economic requirements for science and technology in relation to the most serious limiting factor of the economy concerned" as a basis for the distribution of effort.


Discusses relationship of science and technology to economic growth.


Site selection of industrial research laboratories has become a complex affair involving very special studies.

Since 1951 about 125 science parks have been created in the U.S. and Canada, but about half must be adjudged failures.


The best investment of state funds is to develop one or more universities distinguished in science and industry.


Communities in which R & D industries are located benefit greatly from this industry, and there is fierce competition to attract them.


Three uses of the measurement of the growth of science.

DEUTCH, Michael J. "Can We Afford Atomic Power for Underdeveloped Countries?" BAS, XVI (January, 1960), 23-27.

The cost of atomic energy is still too high for its general distribution.


The relationships among expenditures on basic research, applied research, and national economic growth.

FRIEDWALD, E.M. "The Research Effort of Western Europe, the USA and the USSR" OECD Observer, Special Issue on Science (February, 1966), 10-15.

Report of a study of "three great areas which are comparable in population and resources and which constitute the main centers of scientific activity in the world."


Governmental planning of scientific activities must be channelized and planned for.

Four countries in different stages of development are using education to build up their human capital.


The relationship between science and economic growth in the U.S. and steps for strengthening economic health by the proper support of science.


The community of interest between government and industry and new national policies to insure effective use of technology in industry.


The demands placed on education by constant economic, social and technological changes.


Factors in a country's S.T.P. (scientific and technical potential), and the usefulness of UNESCO's assistance in planning national scientific policy.


"Major programmes" administered by national or international authority, as valuable instruments of industrial strategy for both underdeveloped and wealthy nations.


The development, costs, and political implications of the distribution of atomic fuel in the event of widespread use of atomic power.


Survey of research and development effort in Western Europe, North America, and the Soviet Union.

Background paper for the OECD Ministerial Meeting on Science held in Paris, October 3-4, 1963.


"There is a danger that economic growth will be hindered by the fact that engineers leaving college are rarely capable of exploiting the full potential offered by computers, which call for specialized mathematical knowledge."


Report of an experimental attempt to link scientific and technical research policies in a number of OECD member countries with development objectives.


Conclusions about this relationship and about the complementary roles of government and industry in funding research and development.


Absolute and relative comparisons of resource allotments in money and manpower.


Inconsistencies in current pattern of government support and questions about returns in certain fields of research being commensurate with, or greater than, the cost.


Technology, its relations with economics, their joint status in regard to public policy, and the use of skills and knowledge they involve in the conduct of public business.

The problem-creating effects of science need to be balanced by its problem-solving effects.


Compares industrial productivity and technological education of Britain and the U.S.


The challenge posed by technological progress to the national economy.


"...We may in the nineteen sixties witness a revolution in economic thought, when investment in education and research will become emancipated from the family of 'exogenous factors' and take its due place among the variables of traditional economic theory."


The relationship between national expenditure on research and development and economic growth.

5.1.3 SCIENCE AND INTERNATIONAL RELATIONS

BLOUNT, B.K. "Science as a Factor in International Relations," Int Aff, XXXIII (January, 1957), 71-78.

"Science is now the main factor enabling a nation to prosper in peace and to win wars."


Scientific genius is proportional to population so that in time China and India will produce more scientists than other countries and consequently will be the major powers of the world.

The dangers inherent in the problems of a world of rapid technological change can be minimized through strengthening and expanding international cooperation.

BUTTERFIELD, Herbert. "The Scientific Versus the Moralist in International Affairs," Int Aff, XXVII (October, 1951), 411-424.

Scientific thinking applied to 18th century politics more realistic than the moralistic, ideological approach of today.

DEUTSCH, Karl W. "The Impact of Science and Technology on International Politics," Daedalus, LXXXVIII (Fall, 1959), 669-685.

Some of the misunderstandings about the impact of modern technology on politics and the need for rethinking of basic political concepts.


The nature of relations between nations conditions international scientific cooperation, and the spread of scientific cooperation and achievement makes for better international understanding.


The importance of the interrelationships among science, government, and foreign relations for a small developing country.


The greatest social problem facing the world is the economic and technological gulf between "the rich countries of the northern part of the world and the southern part, the tropical zones. . . ."


The contrast between traditional social and political attitudes and the conditions of the nuclear age leads to four paradoxes which entail pursuing the nuclear arms race and trying to control it at the same time.

Investigates the road to nuclear disarmament.


Describes the problems of international relations of science in government-connected and nongovernmental organizations.

5.2 SCIENCE IN SELECTED COUNTRIES

5.2.1 UNITED STATES

5.2.1.1 GENERAL


The role of science and engineering professors as consultants to government and industry and the effect of this activity upon their educational institutions.


A bill under consideration in Congress for modifying the laws regarding part-time government advisers.


The improved standing of social sciences in the federal government from 1950-1960.


A report on issues of integrity arising from recent scientific developments in the U.S. under the pressure of social demands.


The expected growth of science in the U.S., the sources of support, and the need for coordination.
   The misuse of political power with regard to the responsibilities of the atomic age.

   The new concern with public support for basic research, growing interest in the biological sciences, and more support for higher education.

   "The foundations for effective Presidential action in matters of science and technology" and some remaining long-term problems to be faced.

   "Technology's effects are suddenly calling into question the viability of our political institutions to a degree unknown at least since the Civil War."

   Support urged for the establishment of a National Science Foundation and an Atomic Energy Commission.

   The chairman of the Subcommittee on Science, Research, and Development of the House Committee on Science and Astronautics discusses problem areas for science and public policy and organization for science in the U.S. government.

   Government spending in social science research should be scrutinized and re-formed; priorities should be established; in-house research should be reduced, and quality rather than quantity should be stressed.

   The balance of central scientific organization and a plurality of interests and structure throughout U.S. history.

An analysis by the Chairman of the Select Committee on Government Research at the House of Representatives. (See also comments by Raymond E. BIRCH, ibid., pp. 77-80.)


Science policy experience in the U.S., with special attention to areas of relevance to Australian problems.


The scientist and the politician have placed each other in healthy perspectives in a new phase of the relation between science and government. (See also comments by Donald G. STURGES, ibid., pp. 91-93.)


Twenty-one articles on the relationship of agriculture to U.S. foreign and domestic policy.


The Hope-Flannigan Act as it would affect the organization of agricultural research and policy.


The role of government, of agricultural associations, of the individual farmer, and of agricultural scientists in forming policy.

HARRIS, Fred R. "Political Science and the Proposal for a National Social Science Foundation," APSR, LXI (December, 1967), 1088-1095.

Arguments for a National Social Science Foundation which would be separate from the present National Science Foundation.

A program to strengthen government science in the U.S. better to meet the Soviet challenge.


A discussion of federal support for science and some suggestions for future policy.


The federal organization for marine sciences and prospects for progress.


A proposal to bring together all federal scientific activity under one cabinet department.


Remarks on scientists' participation in government, international organizations, and foreign service.


Such questions as: Is leadership in basic research essential to leadership in applications? What is a position of "leadership" in science?


President Kennedy suggests four areas for concern: development of natural resources; oceanography; atmospheric studies; and the effects of technology on the environment.


Examples of the Panel activities of the President's Science Advisory Committee concerned with civilian science and technology.

Recent actions by the federal government which help science and technology to benefit the nation.


The restriction of communication in science, the evaluation of commercial products by government scientists, and federal support of science.


Present situation characterized by lack of information and foresight.


Corrects the principal misapprehensions concerning social science expressed in the Senate hearings, which resulted in the exclusion of the social science section from the bill establishing the National Science Foundation as passed on July 3, 1946.


A British critique of the duplication of effort, lack of coordination, and relatively low status of scientists in the U.S. (See also LEAR, John, "A Reply to Dr. Mendelssohn," ibid., III, January 9, 1958, 18.)


A policy statement describing how President Nixon feels America should meet the world's scientific challenge.


A statement on the role of scientists in times of national emergency.

New agencies and divisions of science in government and the need for scientists who have an understanding of public policy to fill the new positions.


Statement, conclusion, and recommendations on "the problems which center on the advancement of science by basic research and the making of scientists by graduate education."


Text of the report of the committee chaired by James R. Kiliman, Jr.


Some of the political and constitutional problems resulting from the influence of science.


Science as the major "establishment" in the U.S. political system and its role and the dangers involved.


New policy problems call for considering closer coordination and the role of science in public policy.


In the future public support of science will depend less on its pragmatic aspects and support for basic research will grow as that for applied research and development levels off.

The interdependence of government, universities and scientists seen as providing an opportunity for comprehending the vital nature of the nation's intellectual resources and for formulating policies to cultivate them for the public good.


A study of the House Subcommittee on Appropriations for the Departments of Health, Education, and Welfare (HEW) and Labor and its new chairman.


Science-government relations in the U.S. since its founding and recommendations for improving present government scientific efforts.


A model of science as a social system and three points of policy which could help protect the incentive-system of science under federal support.


A British scientist discusses the influences which have made the U.S. a world leader in science in the past forty years.


The possibilities of "big science" ruining science and the U.S. financially, and suggestions for future science programs.


The role of science in American society, how government should use science, and the scientists' problems in organization.
5.2.1.2 ADVICE AND POLICY MAKING


Discusses the advisory system with emphasis on its negative features.


Describes the Office of Science and Technology in the U.S. government.


Discusses the real sources of political power, the influence of the general public, and the advantages of a scientific approach to decisionmaking.


Congress has both the responsibility and the ability to make correct scientific decisions.


Federal organization of scientific activities, including those of the President's Science Advisor and the Office of Science and Technology.


Comments on the role of scientific advisors and administrators in government.


Findings of the Daddario House subcommittee.


The President's Science Advisory Committee and its influence on American science and society.

The sources of information for Congress and the importance of political aspects over technical aspects.


The relationships between scientists, universities, and the federal government in the current age of the scientific revolution.


Roles of the President's Science Advisory Committee and the National Science Board.


The procedures employed in the Executive Branch for achieving communication with a divided scientific community in making "mixed decisions," and three proposed improvements in decision-making.


The relationships between science and government; the representation and influence of scientists in the Executive; and the kinds of roles in public science which scientists fill.

LOWE, George E. "Congress and Scientific Advice," BAS, XXI (December, 1965), 39-42.

Some problems Congress faces in asserting its role in science policy making.

Functions and influence of non-specialist advisory committees on the research of the U.S. Department of Agriculture.


Includes: Guidance for the Executive, by Steven R. RIVKIN and Information for Congress, by Philip C. RITTERBUSH.


Suggests a science policy and a unified and comprehensive statement of goals and methods for science, and discusses the problems and possible choices.


The need for a new approach to the Department's science office.


The activities of the Special Assistant to the President for science and technology, and of the Office of Science and Technology, of which he is Director.


The low percentage of scientists in Congress is bound to affect the development of the basic sciences.

5.2.1.3 EDUCATION


Proposals to make science teaching in high schools more attractive.


Criticisms of the 1964 report of the Committee on Science and Public Policy, NAS.


The federal role is "to promote and assist in the establishment of high quality programs in all of the states...".

BERKNER, Lloyd V. "Graduate Centers: Key to Innovation," Ind Res, VI, No. 4 (April, 1964), 66-74.

Education, science, and the community call for more geographically-distributed centers where graduate students can engage in advanced research while being trained.


A critical examination of the Educational Policies Commission's volume, The Education of All American Youth.


The nature and magnitude of the economic problems of American academic science and an assessment of the nation's ability to cope with them.


A cost analysis of the national effort required to provide funds to maintain present levels in education for the growth of science and engineering.

The practices of a number of U.S. corporations in establishing and maintaining good industrial-educational relations.


Institutional and governmental plans to develop 15-20 additional colleges and universities with superior educational and research facilities.


The Director of the National Science Foundation outlines some of the benefits of the kinds of NSF support to higher education.


A discussion of federal support of science in the universities.


The traditional academic influence on government in the fields of law, economics, and politics and the increasing influence of scientists.


Functions of the Norwalk State Technical Institute in Connecticut. (See also remarks by H. L. FUSFELD, ibid., pp. 297-300.)


Such needs of the federal grant university as federal research centers near or identified with the university; research people teaching at no cost to the institution; and a National Foundation for Higher Education.


Strategy for increasing the yield of scientifically-trained manpower.


Aspects of Congressional support of scientific research, stressing need for more contact between legislators and universities.


The Graduate Engineering Education System, which provides educational services for modern, science-oriented industries.


Description of the open-door, comprehensive community college concept and its role in industrial development. (See also remarks by Joseph C. SCHUMACHER, ibid., pp. 397-399.)


The hidden dangers in federal support to higher education and an inquiry into what would be of present benefit to it.


Ways in which the universities can and should become more business-like in seeking and managing government-supported research.

Programs of the National Science Foundation and the Fund for the Advancement of Education which deal with science education.

PIERCE, J. R. "What are We Doing to Engineering?" *Science*, CXLIX (July 23, 1965), 397-399.

Criticism of government support of research in engineering as turning much engineering education away from productive civilian economy in favor of defense and space.


Evaluates the program of National Research Fellowships.


Followed by other articles on government support of medical education, *ibid.*, 718-732.


The utilization of national laboratories for graduate training could ease the strain on the universities and is presently occurring to a very limited extent.


Three articles from a symposium: Crisis in Science Education: Current Problems in Perspective, by Charles DOLLARD; Role of the Federal Government in Science Education by Alan T. WATERMAN; and Nation's Interest in Scientists and Engineers, by Arthur S. FLEMMING.


New patterns needed for the relationships between science and federal programs, such as diversity and variety of federal support for basic academic functions beyond the usual project support.

Report on the 5-year High School Graduate Study, University of California, Berkeley, "designed to investigate the general Intellectual and nonintellectual development of 10,000 high school graduates in 16 communities across the U.S."


Comments on a survey conducted by the Division of Medical Sciences of the National Research Council.


The possibility of turning federal laboratories into federal universities in order to use scientists as teachers in the hope that education will increase the number of trained scientists and engineers in the U.S.


Increasing funds for research have brought great benefits and problems about government-university relationships.


5.2.1.4 SELECTED PROGRAMS AND AGENCIES

5.2.1.4.1 ATOMIC ENERGY AND THE ATOMIC ENERGY COMMISSION


Describes the role and functions of the Joint Committee on Atomic Energy.

Organization and activities of the Atomic Energy Commission.


The federal government program to develop engineering and industrial uses for nuclear excavations and contained explosions.


Effects of the bomb on various aspects of American society.


An examination of the basic changes made in the 1954 Act from that of 1946.


A comparison of motives.


The activities of the Atomic Energy Commission.


The Los Alamos Scientific Laboratory as an example of the three-way relationship among universities, national laboratories, and the federal government.

Describe the function, policy, and activities of the laboratory.

MARKS, Herbert S. "Congress and the Atom," BAS, V (February, 1949), 44-47.

The way Congress has adapted itself to handling issues concerning atomic energy.

Medical Board of Review. "Medical Board of Review Reports to the U.S.A.E.C.," BAS, III (September, 1947), 272-274.

Condensed form of the report to the United States Atomic Energy Commission.


The extent to which the development of atomic energy is a threat to the system of private enterprise.


A detailed description of the structured setup under the Atomic Energy Act of 1946.


Reviews a report by the United States Atomic Energy Commission on civil nuclear power and the commission's development program.


Considers the relationship between private enterprise and government as involved in the development of nuclear energy.


Describes the functions and present activities of the Joint Committee on Atomic Energy and speculates on its future endeavors.

Summary of testimony given at 14 meetings of the Congressional Joint Committee on Atomic Energy on the problems of defining a federal policy on atomic power development. (Continued, Idem., BAS, IX, November, 1953, 341-344, and December, 1953, 380-382.)

A report on the progress and the state of the AEC at that time.

Report by the Industrial Advisory Group of the Atomic Energy Commission indicating ways in which industry might increasingly participate in atomic energy development.


Compares national objectives and short-term programs with technical and economic aspects of long-term programs in nuclear power.

5.2.1.4.2 NATIONAL INSTITUTES OF HEALTH

Criticism of the findings and recommendations of the Wooldridge Committee on the operation of the National Institutes of Health.

Suggests that the working principles of systems analysts be used by those who plan national medical research, rather than the skillful opportunism hitherto employed.

Background of past support and statistics, death rates, and projects that received support in the U.S.


Discusses Representative Fountain's report criticizing the distribution of research funds by the National Institutes of Health.


The contract program of the National Institute of Allergy and Infectious Diseases under the National Institutes of Health.


The mission and structure of the NIH and the problem of scientific freedom and productivity in a government research institution.

SHANNON, James A. "The Place of the National Institutes of Health in American Medicine," NEJM, CCLXIX (December 19, 1963), 1352-1357.

Reviews government-supported medical research in the U.S.


The development of the National Institutes of Health grant program for increasing the stability of research careers in medicine and related fields.


The National Institutes of Health are giving widespread support to biomedical engineering research and training programs.

The creation of the National Institutes of Health and the research branch of the U.S. Public Health Service, and the kinds of research carried on under it.


Medical research after W. W. II has received generous Congressional support.


The National Institutes of Health are more interested in research than in the application of research, and some of the policy and administrative difficulties involved.

5.2.1.4.3 NATIONAL SCIENCE FOUNDATION AND THE NATIONAL SCIENCE BOARD

ALLISON, David. "The National Science Foundation," ISt, LII (April, 1966), 76-86.

The accomplishments of the National Science Foundation and the attitude of Congress toward it.


A critical summary of the report of the National Science Foundation to the public and a plea for an increase in its budget.


Interviews with Eric WALKER, out-going chairman of the National Science Board, and the new chairman, Philip HANDLER.

Specific functions, organization, and fellowship and grant programs.


How the National Science Foundation could be administered.


DANILOV, Victor J. "Mohole: Boondoggle or Bonanza?" Ind Res, VI, No. 7 (July, 1964), 32-43.

The origins, scientific importance, present status, hotly debated opinions about this deep drilling project, and its future.


The relationship of medical research to the National Science Foundation.

GRAY, Dwight E. "An Interview with the Director of the National Science Foundation," Phys Today, IV (June, 1951), 6-8.

Functions and major activities of the NSF as related by its director. (For an account of the accomplishments of the NSF during its first year, see same author, "NSF-One year Later," ibid., V (July, 1952), 13-15.)


HAWORTH, Leland J. "Support of Political Science by the National Science Foundation," APSR, LVIII (December, 1964), 1086-1088.

Statement on support of the field by the director of the NSF: "The Foundation will support research designed to elicit the scientific understanding of social processes and behavioral phenomena, but not studies designed to endorse particular social policies or to promulgate solutions of specific social problems."
HORNIG, Donald F. "National Science Foundation." CUN XLIII (July 5, 1965), 62-65.

Discusses the Foundation's becoming a great force in American science and states that it does not fulfill the leadership role as early supporters thought it would.

JONES, Alfred W. "The National Science Foundation." Sci Am, CLXXVIII (June, 1948), 7-10.

Reviews the purpose, scope, and methods of the newly established NSF.


A history of the NSF from its inception to 1954, with emphasis on expenditure of funds and on meeting the greatest needs among the various sciences.


An evaluation of a program the major objective of which is to increase the number of institutions of recognized excellence in research and education in the sciences.


Proposals for a National Science Foundation and reasons why social science should be included in it.


Reports Congressional criticisms of the National Science Foundation.

SMITH, Homer W. "Present Status of National Science Foundation Legislation." JAMA, CXXXVII (May 1, 1948), 17-22.

Discusses the issue of control of the NSF.
Section 5


A discussion of the difficulties facing the National Science Foundation in its development of the nation's resources of scientific manpower.


Describes the activities of the NSF which tend "to establish policy with respect to the support and encouragement of basic research and education in the sciences by the federal government." (See also idem., "The National Science Foundation," Impact, XI (No. 4, 1961), 199-222, for a discussion of the Foundation's main programs and its relations with universities, the scientific community, and federal agencies.)


Describes support of biological and medical research by the National Science Foundation.

5.2.1.4.4 SPACE AND THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION


A balanced and diversified program for NASA would be preferable to any single goal.


The major goals of our space program after completion of the Initial Apollo moon voyage.
Science, Government, and Public Institutions


The politics, dollars, and technology behind this costly venture.


The attitudes of Congress toward the space program and its role in making space policy.


The Deputy Administrator of NASA reviews its activities.


Describes cooperative space activities carried on by the U.S. National Aeronautics and Space Administration with other countries.

"The United States Space Program and Its International Significance," Annals, CCCLXVI (July, 1966), 89-98.


The U.S. rocket and satellite programs after W.W. II might have achieved the orbiting of a satellite by 1951 had they been supported by the War Department.


The Manned Space Flight programs of NASA and some of its problems.

Declares that the U.S. project to land a man upon the moon has passed its peak and discusses a number of alternatives for the next steps to be decided upon.


A review of the U.S. system devised to transfer space technology to potential beneficiaries, especially to the Aerospace Research Applications Center.

KERR, James R. "Congress and Space: Overview or Oversight?" PAR, XXV (September, 1965), 185-192.

Suggestions to overcome the difficulty of Congressional control over science projects such as the space program.


Lack of clear goals beyond the manned lunar landing has created uncertainty and alarm at the universities which have provided scientific leadership for NASA's program.


Ways in which NASA is concerned with science and the future of space science under NASA.


A British view of the newly-established National Aeronautics and Space Administration.


Reviews scientific opportunities, instrumentation problems, and sources of support.

The future of space programs and the importance of forecasting for any space program in a review of NASA's forecasting methods.


How technology and the maintenance of peace have been enhanced at less cost to other endeavors than is often supposed.


General account of NASA's approved programs with the universities.

5.2.1.5 SCIENCE AND FOREIGN AFFAIRS


The experience of organizing exchange visits with Soviet scientists and suggestions for making such programs more useful to the scientists on both sides.


The dangers inherent in America's rejection of Russia's proposal for privately-arranged exchanges between scientists and artists in both countries.


Misuse of medical science for foreign policy purposes and constructive uses of health as in the U.S. Foreign Operations Administration and the World Health Organization.

DRECHSLER, Gerhard J. "The U.S. State Department and World Science," BAS, VII (April, 1951), 121-122.

The State Department's activities in support of international science and the exchange of scientific personnel.

The implications of scientific, technological, and social changes in studies of American foreign policy for the Senate Committee on Foreign Relations.


President Eisenhower's proposal for an international atomic pool.


The need for and usefulness of science attaches in American embassies abroad.


The International Scientific and Technological Affairs (SCI) Unit of the State Department has lacked clear direction because of the unattractiveness of the State Department environment to prominent scientists.


Summarizes the Berkner report Science and Foreign Relations and the resulting establishment of a Science Office in the State Department and science staffs in U.S. embassies abroad.


The work of the U.S. Agency for International Development.

KASH, Don E. "The Tyranny of Realism," BAS, XXIII (February, 1967), 16-20.

The ways in which international space cooperation might have led to peace, and analyzes the actual extent to which NASA's international program was committed to cooperation and change.

The impact of recent scientific and technical advances on international relations and the scientist's role. (See also idem., same title, BAS, XVI (April, 1960), 114-116.)


An evaluation of the activities of the exchange program between the National Academy of Sciences and the Soviet Academy of Sciences.


A program to strengthen cooperative ties between the two countries.


Facts of the exchanges, particularly those of scientists.


U.S. participation in international and bilateral public health programs.


Discusses four problems posed by the participation of scientists in policy-making.


Use of naturalists with active interest in particular environments would benefit the foreign service.


Possible non-military scientific developments during the next decade and estimated impact on foreign relations.

The recommendation of the board of consultants to the State Department, that an International "Atomic Development Authority" be established, provides a more hopeful alternative to the menace of scientific secrecy.


The effect of the immigration laws upon foreign scientists who wish to visit the U.S.


Describes both government-sponsored and private or church-sponsored programs.


5.2.2 UNITED KINGDOM

5.2.2.1 GENERAL


The problem of lack of knowledge of scientific matters by Members of Parliament, the danger of leaving all policy control to the executive, and various methods by which Parliament could play a larger role in discussing and shaping science policy.


The state of British technology and the needs for more personnel, greater financing, and improved organization.

The importance of consolidating Britain's science policy with respect to financing and scientific and technical manpower.


The role of government in civilian scientific research and the division of research between government and other bodies.


The role of Parliament and political parties in formulating science policy.


Government action related to science and suggestions for policy in the light of Britain's shortage of scientific manpower.


The importance of technical innovations to the national economy and a consideration of selective support of science-based projects.


Early history of the organization which administers government grants for medical research in Britain.


Describes attitudes toward utilitarian science, pro and con.

Problems of organization in the light of the boundaries of science, appropriate groupings of activities, areas requiring centralization, and appropriate levels of decision-making.

HISCOCKS, E. S. "Organization of Science in the United Kingdom," Science, CXXIX (March 13, 1959), 689-693.

Significant features of British scientific organization which highlight differences and similarities to the U.S. pattern.


The first Minister for science in the British government discusses his aims and the need for all sections of government to contribute to a policy for science.


Concludes that a space program would cause lopsided development of science in Britain. (Comments on this article by leading scientists: ibid., (August 18, 1960), 446-448; and (August 25, 1960), 508-509.)


The training and use of manpower, mobility between institutions, better coordination of resources, and the study of economic and social aspects of technology mentioned.


Relations between science and the state in Britain since 1885.


Collaboration during W.W. II between Britain and the U.S. on the usefulness of similar arrangements in peacetime.

The Committee's structure, aims, activities, and attitude toward lobbying.


Concludes that a British space program is indispensable to technological progress and defense.


A history of the organization of government science and a description of its research activities.


How dissatisfaction with economic position caused major parties to pledge greater emphasis on research.


Review of an OECD study which compares the science policy of Britain and that of West Germany.


Two articles on the policies of Britain's major parties: The Labour Case, by Reg PRENTICE; and The Conservative Challenge, by the Earl of BESSBOROUGH.


The broad objectives of the two countries and the institutional structures within which science policy is made and implemented.
Section 5


The need for proper administration of Britain's science and technology.


The structure, scope, and functions of the Committee.


Reviews the annual report of Britain's Advisory Council for Scientific Policy.


Comments on a recent scientific policy statement of the British Labour Party.


A discussion of factors encouraging successful research and its application, with examples from Britain's wartime experience.


The issues facing British science policy makers show that new research management skills must ensure the continuation of the research program.


British scientists discuss communication and coordination among the different sectors of scientific activity.


The British Minister of State discusses ways by which scientists and engineers could help bring politics into the scientific age.
Science, Government, and Public Institutions


The attitudes of Britain's major political parties toward support of scientific research.


The history and future of Britain's government medical research organization.


The role of the Parliamentary and Scientific Committee in encouraging scientific and technological progress through education, research, and management.

5.2.2.2 EDUCATION


Pleads for more facilities and support for research in the universities.


Surveys rapid change in technical education and attitudes towards it.


The inadequacies of Britain's traditional system of part-time training.


Describes the kind of institution which Britain needs to train scientists and engineers.


Estimates the value of the proposed council to Britain.

Surveys the progress and perspectives of these colleges.


History of an influential British institution.


An industrialist suggests means by which universities could achieve better cooperation with industry in Britain.


Urges more liberal support for Britain’s best scientific workers in university research.


Discusses reports on the types of postgraduate courses needed in Britain.


University training in Britain for pure and applied scientists and statistics for the numbers of graduate students.


How the English system allows the gifted child to specialize and advance rapidly in science and mathematics.


Report of a discussion at the British Association meeting dealing with the adequacy of education of men of science and suggesting improvements.

Surveys developments in British higher education since 1952, particularly the expansion of the Imperial College of Science and Technology.


Describes recommendations of a British committee on higher education, with emphasis on proposed changes for scientific and technological education.


Three articles stressing the need for more research funds in Britain: The Trend Towards Stifling Basic Research by Bernard LOVELL; Our Political Leaders Must Have Courage, by N. F. MOTT; Not a Luxury, but a Dire Necessity, by Hans KREBS.


Studies the role of the Colleges of Advanced Technology in Britain.


A new British institution for postgraduate training.


The inaugural seminar of the Science Studies Unit at the University of Edinburgh.


Suggests that Britain follow the U.S. example of setting up research institutes closely associated with universities.
Section 5


Describes the basic differences between British and American graduate students and presents the British study program.


An interview with S. A. TOBIAS, Professor of Mechanical Engineering at Birmingham University, about the roles of the engineer and the problems of educating persons to fill these roles.


Twelve provincial universities in England offer opportunities in science and technology.

5.2.2.3. SCIENCE SOCIETIES


The work and influence of Britain's leading scientific society.


History of the Society's international relations in its three hundred years.


The value of the British Association for the Advancement of Science as an interpreter of science to the public.


The history, philosophy, and present concerns of the British Association for the Advancement of Science.

The President of the Royal Society proposes including more applied scientists in its membership and considers the relation of the Society to government.


History of the founding and subsequent importance of the Royal Society, with pictures of historical interest.


The Society for the Diffusion of Useful Knowledge, which existed in England from 1826 to 1846, and its work.


History and activities of the Brit.

Describes medals accompanying prizes of the Royal Society, which prizes have had an Important influence on the development of modern science in both Europe and America.


A brief historical account of the oldest learned society with a description of its current activities, public duties, and international relations.


Describes scientific activities of the Society and the zoo itself.


Suggests avoiding the proliferation of learned societies, especially those relating to science and technology in Britain.


Describes the Association's membership, policy, and activities.


An address to the Indian Science Congress describing the history and functions of the British Association.


Past and present international activities.


The creation of a National Academy of Engineering in the U.S. strengthens the view that such an academy would be desirable in Britain.
5.2.2.4. SCIENTIFIC MANPOWER


The employment of foreign scientists in such advanced countries as England and the U.S. is at the expense of the development of their own countries.


A British Civil Service commissioner discusses personnel shortages.


Suggests changes in the educational system, encouragement of women to take up science, and better use of present personnel.


Britain's prospective scientific manpower needs and suggestions for increasing the supply of personnel.


The managing director of Careers Incorporated, which recruits British technologists for work in the U.S., makes suggestions for utilizing more of their talent in Britain.


Better recruiting procedures by means of coordination between industry and the universities.


A survey of the numbers of emigrants, their qualifications, and their reasons for leaving Britain.

Concludes that the "brain drain" of British scientists is not as serious as it seems because most of the emigrants return.


Estimates that by 1970 Britain will have a great shortage of trained scientists and technicians.


The 1965 British Manpower Report shows that soon the demand for scientists and engineers will outstrip the supply.


An economist questions the claimed shortage of scientists in Britain.


Discusses engineering education in Britain and whether it puts enough emphasis on practical problems.


Report from the British Association of Science Workers symposium at which speakers from Britain, India, and Ceylon discussed the "brain drain" of their scientists and policies to cope with it.


Personnel policies applied to scientists in the British Civil Service.


Review of a address by Willis JACKSON, which deals mainly with education.
Two views of the migration of British scientists and engineers to the United States. Includes: Little Britain in the West, by Richard RUSHTON; and Making Sure there's No Place Like Home, by Alastair GEBBIE and Katherine GEBBIE.


A discussion of opportunities for women in science and technology and the reasons for the small number of women scientists and engineers.


The numbers of British scientists who emigrate to North America and the steps being taken to reduce this emigration.

. "Too Many Scientists--or Too Few?" New Sci, VI (December 17, 1959), 1258-1260.

Supports the view that Britain needs to increase its output of scientists and engineers. (See also Idem., "A Surplus of Scientists?", New Sci, XII (October 19, 1961), 181-183, which questions a report that predicts a surplus of scientific manpower in Britain.)


Analyzes the emigration of British scientists and engineers to the U.S. and suggests that international measures of control be adopted to check this process.


Results of a U.S. survey to find out which British scientists had emigrated, and why; their positions and kind of work in North America; and their feelings about having emigrated and their future intentions.


Discusses the British campaign to produce more scientists and technicians.
5.2.2.5. ATOMIC ENERGY


Summary of a White Paper presenting a plan for producing a substantial portion of Britain's electricity from nuclear power by 1965.


A review of Britain's atomic energy program since 1948.


British industry has been quick to apply the results of scientific advances in developing nuclear power stations. (See also CALDER, Nigel, "How They Are Building Nuclear Britain," ibid., IV July 17, 1958, 413-418.)


Britain's nuclear power stations have failed to provide cheap electricity and have not been able to compete with American plants on the export market.


Britain's nuclear industry is being studied by a Select Committee on Science and Technology which may recommend improvements in organization.


Proposals for reorganizing Britain's nuclear power program.


Relates the developments since 1946.


A report on Britain's application of atomic energy for peaceful pursuits.

Reviews accomplishments of the Atomic Scientists' Association in Britain.


Describes Britain's military and civil nuclear energy programs and their economic and political effects.


Describes the work at Harwell, England.


The comments of leading scientists concerning this new institute in Britain.


The history of Britain's atomic power program and suggestions for its future course.


(Continued in *ibid.*, September 22, 1956, 624-626.)


Britain's fuel policy and the need for further development of the nuclear-power industry.

Problems of atomic energy control and disarmament and also the question of sharing atomic secrets with the U.S.S.R.

5.2.2.6. INDUSTRY AND TECHNOLOGY


Extract from an address criticizing the industrial structure, government procurement, and the organization of research and development.


"Views on the problems of the place of engineers and technologists in contemporary British life and the relations of the Royal Society to technology and engineering."


British industry should be more ready to exploit the discoveries of British scientists.


Describes a newly-formed British government department.

FISHLOCK, David. "Blueprint for British Technology?" New Sc, XXXII (December 1, 1966), 515-517.

Suggestions for research and development to be carried out under a new Minister of Technology in Britain.


Suggestions for extracting more civil benefit from Britain's major national technological projects.

The costs of fundamental research and the shortage of personnel call for greater cooperation between government and industry in Britain.


The Director of the National Research Development Corporation makes suggestions for the deployment of Britain's technological resources.


Collaboration between the Massachusetts Institute of Technology and nearby industry could be a model for strengthening research and development in Britain.


The impact of research, factors that limit progress, future prospects, and lessons for Britain.


Describes the organization of this new laboratory, which will be concerned mainly with investigations of enzymes.


Compares the electrical industry in Britain with that in the U.S.


The contribution of industrial research in Britain, with special reference to the role of government.

Reviews on investigation into the application of science in British industry.


Summary of a report by the Federation of British Industries. (See also ibid., "Pattern of Research in British Industry," 232-240, in which the distribution of research effort and the obstacles to research and development efforts in small firms are discussed.)


The research stations and other functions of this new British ministry.


The need for national planning in Britain to meet the challenge of technological change with the interests of both labor and management in view.


Calls for revising the organization and administration of the British system of allocating funds for oceanography.


Post-W.W. II growth has been the result of planning and cooperation by scientists, industrialists, and government.

5.2.2.7. SCIENCE MUSEUMS, INSTITUTES, AND RESEARCH CENTERS


The research program of the Cavendish Laboratory at Cambridge University.
Science, Government, and Public Institutions


Facilities, staff composition, and research provisions for work which will primarily concern mammalian development.


The latest work and facilities of the laboratory.


History and present activities of the London Natural History Society.


The new National Institute of Oceanography in Britain and the progress of research.


Work of the British agency for the conservation, research, and management of nature reserves.


The history, location, facilities, functions and directors of the laboratory.


Reviews of the annual reports of the Nature Conservancy.


Brief summary of the activities of the laboratory in London and at outstations.

Past and present functions include the introduction of new plants of economic value to countries of the Commonwealth, preparation of floras and indices, and research and practical training.


The Institute's 1963 activities in genetic and agricultural research.


A station set up by the British Department of Scientific and Industrial Research to work in any field not undertaken by another research body.


History of "the oldest scientific institution in Great Britain; founded in 1675 as a site for making observations to assist navigation."


The lay-out and functions of this new station of the Nature Conservancy in Britain.


The facilities of the unit sponsored by the United Kingdom Development Commission.


This independent institution undertakes "a wide range of scientific and technical operations for Industry and government agencies in the United Kingdom and overseas."


The NINA electron accelerator at the Daresbury Nuclear Physics Laboratory.

Description and photographs of Britain's famous botanical center.


Brief account of the history and research functions written to commemorate the bicentenary of Kew Gardens.


A description of the British national museum of science and industry.


An account of the developing trends of research at the station, the purpose of which is "the study of problems which are met with in the actual culture or growth of fruit trees and bushes."


History of the British observatory from 1675 to the present.


Reports on recent publications by the National Physical Laboratory.


Complete reports on the Centre at East Kilbride.

5.2.3 CANADA


A bill before the Canadian House of Commons is so written that the Bell Telephone Company would be permitted to take over all future communications media, thus leading to eventual nationalization.


A system has been devised which is believed to avoid "the dangers of changing political views and at the same time maintain...an effective control to insure a high level of competence."


The work and expansion of this Foundation established to foster applied and industrial research in Nova Scotia.


Recent Canadian developments in industrial research management.

JOHNSON, Harry G. "The Economics of the "Brain Drain": The Canadian Case," Minerva, III (Spring, 1965), 299-311.

The emigration and immigration of trained persons and the advantages of this process of talent exchange.

LARKE, John H. "At Ontario's New Centennial Centre of Science and Technology, the Word is PARTICIPATION," Can Sci, (Fall, 1967), 31-32.

Plans call for the visitor not only to see, but to touch and operate the scientific artifacts on display.


The organization and range of the Canadian atomic energy development.

The Institute fosters original and academic research on north Canadian problems and assists in the training of humanists, scientists, and engineers.


The origins, occupations, and geographical distribution of Canadian-trained scientists and the productivity of Canadian universities.


Government assistance for research and development consists of scientific services, financial aid, and tax incentives.


Briefly describes "Canada's largest scientific organization."


Government programs and agencies concerned with industrial research and development and a comparison of Canadian research and development needs with those of the U.S.


Describes a government-backed research community in Ontario for scientists and engineers from different companies.


A survey of progress in universities, industry, and government laboratories.


Organization and objectives of one of Canada's largest industrial research organizations.

A survey of problems and policy.

5.2.4. AUSTRALIA

ABBOTT, P. O. and L. O. GOLDSMITH. "History and Functions of the Commonwealth Health Department, 1912-1952," Pub Ad Aus, XI, No. 3 (September, 1952), 119-128.

This Australian department has greatly extended its operations and services since 1949, including expanded health research.


Work of the Commonwealth Scientific and Industrial Research Organization of Australia.

COOK, P. H. "The Development of Research In a Commonwealth Department," Pub Ad Aus, VII, No. 2 (March, 1948), 73-80.

History of the establishment of the Industrial Welfare Division of the Department of Labor and National Service in Australia and its use of industrial psychology.


The objectives of the Australian food and agricultural policy and the suitability of the Commonwealth Department of Commerce and Agriculture to meet them.


Describes a new institution in Australia.


Australian science policy problems.

Analysis of research and development policy in the Australian Defence Standards Laboratory.


Public administrators need a general knowledge of scientific developments in view of Australia's limited resources for research.


Bolder irrigation measures would benefit both food production and conservation in Australia.


The history, financial support, and relationships of the Australian C.S.I.R.O. with universities and other government departments.


Describes expansion of an Australian university.


The history of meteorological work in Australia since 1906 and its relationship to the World Meteorological Organization.

McKNIGHT, A. D. "The Role of the Public Servant in Research," Pub Ad Aus, XX (June, 1961), 139-154.

The need for scientific research over the whole gamut of government activities, as based on Australian experiences.


Generalized historical account of such impacts and their results.

Australia should consider the development of institutionalized studies of strategic problems outside the defense establishment.


Technological innovations and their possible impact on the role of public servants in Australia.


Discusses trends and problems in Australian government expenditures for science.


The experience of the Australian government's sponsorship of civilian scientific research within the Commonwealth Scientific and Industrial Research Organization, (C.S.I.R.O.).


A public policy decision is needed to commit the government and the people to scientific research for food production in Australia.


Historical commentary on nuclear power in Britain and the formation and prospects of the Australian Atomic Energy Commission.


Describes the activities of the Australian Atomic Energy Commission and the opening of its first nuclear reactor station.
5.2.5 WESTERN EUROPE

5.2.5.1 GENERAL


Traces European scientific development through the solar, chemical, and atomic eras.


A Dutch physicist comments on some trends in European science.


Concern for the proliferation and overlap of various bodies and a policy for participation in international organizations.


European economic and technological dependence on the U.S. is not inevitable if an enlarged Common Market can be established.

COPISAROW. "The Key to Europe's Prosperity," New Sci, XXXIV (June 1, 1967), 522-524.

The need for strengthening Europe's technological development to compete with the U.S. and suggestions for meeting this competition.


Comparison between academic research in free Europe and the U.S.

Outstanding features of the organization of scientific research and the general level of scientific activity in the various European countries.


It is imperative for Britain and Western Europe to develop a policy that will keep them in the advance of space technology.


Describes post-W. W. II resurgence of scientific research in Europe and states that bonds with American science are strong and useful to both parties.


The reasons for the abandonment of the traditional laissez-faire attitude toward science and the impact of this change on scientific organizations in Western Europe.


The influence of political and economic developments and of changes in the nature of science upon the scientific scene in Europe.

KRAMISH, Arnold. "Industrial Research In Western Europe," Ind Res, VI, No. 2 (February, 1964), 40-44.

R & D is being rejuvenated by all types of expanding industrial research organizations and by increasing interest in applied research.


A description of the most famous European science museums.

"The extra funds...squeezed out of tight national budgets are going mostly into quick-return R & D projects at the expense of growth in basic research."


The benefits and dangers of "farming out" American R & D projects to European laboratories.

5.2.5.2 FRANCE


Describes the French policy of national and collective programs.


A survey by a French physicist.


The new Institute of Science and Technology at Lyon is to produce engineers and technicians in less time than the traditional system required.


A factor limiting French industrial research is the low productivity of smaller French companies contrasted to the larger ones of the


French policy for high-energy physics research stresses international cooperation.

KOWARSKY, L. "Atomic Research in France," BAS, II (October 1, 1946), 7-8; 25.

Describes the structure and responsibilities of the French Atomic Energy Authority. (See also idem., "Atomic Energy in France," BAS, IV, May, 1948, 139-140; 155, for further discussion of the French Atomic Energy Commission.)


Includes: Franco-Soviet Space Pact, by Kenneth GATLAND; Force de Frappe, by Nigel CALDER; Vigour in Aeronautics, by E. Colston SHEPHERD.


Study of broad national science objectives, institutional structure of science policy making, and public financing of research and development.


France has a basic and highly formalized national philosophy and structure for science.


The French organization to develop nuclear power.

The university's research departments maintain close relations with industrial laboratories.

WALSH, John. "France: First the Bomb, Then the 'Plan Calcul'," Science, CLVI (May 12, 1967), 767-770.

The French government is in earnest about promoting a viable national computer industry and the "Plan Calcul" is realizing its objectives in computer functioning.


Analysis of reasons for inclusion of the physical and natural sciences in the curriculum of the Ecoles Centrales, and of the practical success of these courses.


A study of the role of science in the Napoleonic educational system and of possible effects of Napoleon's reforms on later French science.

5.2.5.3 GERMANY


The Max Planck Society and the 41 institutes it sponsors have led German science for half a century.


Problems of reestablishing German science in light of Soviet-Western differences, and the background of German science to the end of W. W. II.


Description of the composition and functions of the newly organized Council.

The development and scientific achievements of the technical high schools of Western Germany.


Field Information Agency, Technical, prepared a comprehensive review of fundamental research for the period 1939-46.


MCELHENY, Victor K. "West Germany Debates a 'Cultural Crisis'," Science, CXLVII (February 5, 1965), 589-591.

West Germany achieved its "economic miracle" without spending a great deal on research and is now entering a decisive period in its educational and scientific development. (See also ibid., "West German Research Spending: Plans for 1966-1968," Science, CXLVII, April 2, 1965, 59-60.)


The decline of basic science during the Nazi regime and W. W. II is being remedied by government and private efforts.


Reviews a report by K. H. LAUDER, scientific attaché to the British Embassy, which gives an account of progress since 1946.


Study of the broad objectives of the two countries and of the institutional structures within which science policy is made and implemented.

Cooperation between the Allied occupation powers and German scientists.

ROBERG, Norman B. "Medical Reform in West Germany," *JAMA*, CC (May 15, 1967), 603-608.

The new University School of the Medical and Natural Sciences in Ulm, Germany.


The new Volkenrode Center for agricultural research.


Nuclear energy research and development in West Germany.

5.2.5.4 SCANDINAVIAN STATES


Describes a new grant for publication of the results of scientific work.

The Science Advisory Council of Sweden and some of the issues of the economics of science that need investigation.


An account of the structure and projects of Sweden's program.


How government, industry and research serve to develop Norway's research capacity.


Agricultural science rescued the Danish economy when Denmark could no longer export grain, her chief means of livelihood.


A new research center for neurophysiology and isotopes in zoophysiology.


The structure and educative functions of the Institute.


Describes and evaluates the Norwegian atomic energy program. (See also idem., "The Dutch-Norwegian Atomic Energy Project," BAS, IX, December, 1953, 369-371, in which the work done at the Nuclear Energy Research Center, Kjeller, Norway, is described.)


Includes a description of reactor development in Sweden and Denmark.

The Swedish planning mechanism for industrial research and steps taken to bind university research more closely to industrial needs.


The expansion of scientific and technical training in the Scandinavian countries.

5.2.5.5 OTHER COUNTRIES

BELGIUM


Discusses the broad objectives of science policy in Belgium. Tables of governmental, scientific, and financial organization, and of the 1961-1964 science budget.


The fund and the projects supported by it.

ITALY


Government research problems, particularly in the fields of atomic energy and fundamental biology, and the need for modernizing research organizations. (See also Part II, Science, CXLVII, April 9, 1965, 205-207, where the author discusses the future research climate between the National Research Council and the International Laboratory of Genetics and Biophysics.)

Fully translated text of the 1963 law governing the organization and development of scientific research in Italy. (See also idem., "Science Policy in Italy: A Policy for Scientific Research," Minerva, II, Winter, 1965, 210-224.)

THE NETHERLANDS

BANNIER, J. H. "Z. W. O., the Netherlands Science Foundation," Science, CXIII (February 23, 1951), 197-201.

The origins and financial structure of Z. W. O., its relationship to government and the universities, and science as an integral part of postwar development in the Netherlands.


The deputy director of the laboratories in the Netherlands discusses company history, philosophy, and management practices.


Describes a new institution for higher education in the Netherlands.


History and present situation of science policy organization.


Problems of the Netherlands in making the transition from an agrarian-commercial to an industrial society.
SPAIN


Describes the organizational ramifications of this Spanish institution which was established for the promotion, guidance, and coordination of Spanish scientific research.


Describes the aims, organization and work of this Council.


Summaries of several papers presented at a conference in Madrid in 1964.


Describes the Spanish experiment to coordinate all bodies involved in research.

SWITZERLAND


Describes the Swiss Federal Institute of Technology in Zurich.

5.2.6 UNION OF SOVIET SOCIALIST REPUBLICS

5.2.6.1 GENERAL


The account, by the president of the Soviet Academy of Science, of the history and prospects of Soviet science, with special reference to the five-year plans.

Brief description of the plan.


The role of the Russian scientist in the organization of scientific activity and the social milieu in which he operates; why science is effective even in a socially restrictive atmosphere; and why the Soviet scientist does not directly affect Russian policy.


Soviet problems of science policy are basically similar to those of the West because the Soviets have had to face similar issues.


Letter from I. E. GLUSHCHENKO to Eric ASHBY and his reply.


Describes science in Soviet Russia during the transformation period of 1929-1932.


Discusses the failure to apply scientific discoveries to the needs of industry and the reasons for low productivity of science in the U.S.S.R. (From an article in PRAVDA, January 20, 1966).


Origins and early history of the academy, organized in 1725.

A survey of the state of Soviet science which illustrates the dangers of assuming that all Soviet sciences have met with the atypical handling of genetics.


An address by the President of the Academy of Sciences, U.S.S.R.


The quantity and quality of the Soviet scientific challenge.


America leads in pure science, and unless Russian scientists achieve more freedom, they will not be able to maintain their lead in applied science.


The electrification program in Russia in the 1920's which was the basis for her industrial progress.


RICE, Stuart A. "Statistics in the Soviet Union," BAS, VIII (June, 1952), 159-162.

The distortion of statistics by party-line philosophy is more apparent in theoretical interpretation than in Soviet practice.

The accomplishment of the plan will add to knowledge of norms of evolution, give impetus to productivity of labor, and speed the utilization of natural resources.


Activity in different fields of science, international contacts, scientific personnel, education, and publications.


The great mathematical tradition in the Soviet Union is a legacy of the ancien regime.

5.2.6.2 EDUCATION


The program is an instrument of national policy and combines high standards with mass education.


Education and research situations and the dangers of Communist party control of science.


Reviews a publication of the same name by C. E. SIMMONDS, published by the (British) Society for Cultural Relations with the U.S.S.R.


Describes Soviet medical research and higher education as seen by members of a U.S. medical team visiting Russia in February-March, 1956.
5.2.6.3 SCIENTIFIC MANPOWER


The position of the physician in the Soviet system and the strains of his role in relation to the individual and the state.


Suggests methods of increasing research productivity in the U.S.S.R. through moral opinion, financial support, and personnel policy.


Observations of the Soviet emphasis on awarding honors to scientists as incentives. Also describes the 220th anniversary of the Academy of Sciences.


The state of science in the U.S.S.R. and the "science city" of Akademgorodok.


Comments on official Soviet information which indicate the rapid rate of increase in the professional labor force, and the implications of this increase for Soviet science and technology.

5.2.6.4 RESEARCH AND DEVELOPMENT


Includes: Organization and Planning by Gerald OSTER; and Mathematics by S. LEFSCHETZ.


A polymer chemist visits Russian laboratories where he notes fundamental differences in approach to research and development problems by the central coordination of research.

Describes the government committee that will coordinate Soviet interdisciplin-ary basic and applied research.


Reviews a report by Peter KAPITZA which points out the differences in the organization of science in the U.S.S.R. from that in the West.


Problems created by growth, shifting centers of decision-making, efforts to improve coordination, financial centralization and institutional duplication, criteria of scientific choice, and the status of scientists.


An analysis of Soviet organization and goals for atomic science.


The state of scientific research since the death of Stalin, the lack of political freedom, and financial support.


The organization and planning of Soviet research and the application of low temperature physics in industrial inventions and processes.

Organized and planned government-sponsored research in the U.S.S.R. is compared with that in the U.S., emphasis being placed on the leading role of the Russian Academy of Sciences.


Priorities of research are decided by political leaders after consultation with science advisors, the resulting policy directives providing reliable clues to future research endeavors.


Covers organizational developments from the Revolution to the present, and outlines the general principles guiding science in the Soviet Union.

5.2.6.5 SCIENCE CITY


While this "science city" in the heart of Siberia is unique in many ways, it has failed to have the impact in Soviet industrial modernization that was anticipated.


Russia's science city in Siberia and plans to build a technological city nearby to increase the practical applications of science.


A description of Akademgorodok, a city entirely devoted to science recently built near the capital of Siberia, which makes higher scientific education available to persons whose potential would otherwise go unrecognized. (See also "Science Center in Siberia," ibid., CLII, May 20, 1966, p. 1047, in which Victor K. McELHENY reports the visit of a leading British mathematician to the center, and "What the French President Saw: A Gallic View of Novosibirsk," ibid., CLII, July 1, 1966, pp. 45-46, in which McELHENY comments on President De Gaulle's visit as emphasizing the greater role the center will play in increasing French-Russian scientific cooperation.)

Describes a Russian plan to build complete scientific communities in Siberia as a spur to development in that region.


"Science city" is thriving, with a developing academic tradition of growing interdisciplinary communication.

5.2.6.6 SPECIFIC SCIENCES AND TECHNOLOGIES


Series of addresses presented at meeting of the Washington Academy of Sciences on October 29, 1957. Includes: Inorganic Chemistry, by Charles R. NAESER; Low-Temperature Physics, by Ernest AMBER; Nuclear Physics, by G. M. TEMMER; Agricultural Research and Production, by John H. MARTIN; Crystallography, by J. D. H. DONNAY; and Earth Science, by Phillip H. Abelson.


A British scientist describes Russian scientific and technical work.


Data processing systems are at least 3 years behind those of the U.S. because of the economists' conservatism and the intervention of Russian ideology.


The organization and orientation of nonmedical microbiological science in the U.S.S.R.


Analysis of Soviet agricultural development and the extent to which it is determined by soil, climate, and government administration.

The Russian program for supplying nuclear energy for industrial explosions and the contributions that can thereby be made to world-knowledge.


A descriptive history gleaned from data made available to the West.


Summarizes status of work in geochemistry and gives examples of projects at the Vernadsky Institute and the Institute of the Geology of Ore Deposits, Moscow.


Report of a British astronomer's visit to observatories in the Soviet Union and prospects for Russian collaboration with the West.

MOORE, Barrington, Jr. "Recent Developments In the Social Sciences in the Soviet Union," ASR, XII (June, 1947), 349-351.


Describes the almost-completed high energy accelerator at Yerevan in Armenia.


The Pavlovian system as ideology, the content of Soviet psychology, and the socio-political implications of the science.


Introduction to the official Russian account of the conference on methodology held in Moscow, February 20-21, 1950.
Section 5


Reminiscences of a physicist who worked at the Kharkov Institute of Applied Physics from 1932-1937.


The U.S.S.R. is working on hydrofoils which approach an 85 mph speed, carry 100-ton cargoes, and have varied designs and propulsion systems.


This analysis by a Leningrad University scientist gives some indication of what is expected from the manned and unmanned space shots.


The possibilities for satellite use - a discussion by the Russian winner of the International Prize for the Promotion of Astronautics.


Describes history of Soviet space achievements and attributes successes to national planning.


A report of the Soviet program which covers studies of the skies, meteorology, glacier observations, research ships, studies of the Antarctic ice cap, artificial satellites, and exchange of resulting data.

The beginning of modern science in Russia when Peter the Great imported Western scientists, the progress made later despite rigid Stalinist control, and the improved status of the scientist.


Describes the endeavors and achievements of chemistry in the U.S.S.R. and its status before and after the Revolution.


Recent Soviet oceanographic research in the Atlantic, Indian, and Pacific Oceans.

5.2.6.7 INFLUENCE OF POLITICAL IDEOLOGY

DUNN, L. C. "Science and Politics in Russia," BAS, IV (December, 1948), 368; 384.

An account of the Lysenko genetics controversy.


Contemporary Russian physiology in the light of Russian history and culture.


The climate of ideological controversy which may be analogous to the Lysenko controversy in Soviet genetics.


The dangers to a free science--dictatorships and the organization of teamwork in research--are illustrated by the genetics controversy in the U.S.S.R. and the Lysenko type model of research.

Soviet chemists' discussions about the relevance of Marxist doctrines to the resonance theory in organic chemistry.


A summary of the philosophy obligatory for scientists in communist countries.


A detailed account of the condemnation of Mendelian genetics in the Soviet Union, which signifies the subordination of science to political authority. (See also the issue for June 25, 1949, 974-982. For an answer to Huxley, see N. I. NUZHDIN, *ibid.*, CLXV, May 6, 1950, 704-708.)


Curing the virus diseases of the potato presented as a case history in Lysenkoism by showing the indirect, but pervasive influence of Soviet political ideology on Soviet biology.


A case study of the first fifteen-year phase in the relations of natural science and the Russian Revolution.


Some unique Soviet views related to the intellectual and ideological climate.


An account of the persecution of the Soviet physiologist, L. A. ORBELI, after the death of Stalin as an example of Soviet falsification and revision of important scientific works in an attempt to suppress the "excesses" of Stalin's time.

Relation of the Council to the Presidium of the U.S.S.R. Academy of Sciences and its decrees.


Suppressions imposed on Soviet cosmological researchers by communist ideology.


An historical examination of the controversy.


The official doctrine of dialectical materialism in the Soviet Union in connection with the study of genetics and the leadership of T. D. LYSENKO.


Analyzes discussions held in the Soviet Union on problems of philosophy and the natural sciences.


Speculates on the causes and implications of Russian abolishment of genetics and concludes that an autonomous behavior pattern hostile to science has become rampant in Russian culture.

5.2.7 EASTERN EUROPE


The Council for Economic Mutual Assistance coordinates national policies and plans in science and technology for communist Europe.
BULGARIA


EAST GERMANY

GREENBERG, Daniel S. "Defector's Odyssey: Personal Look at Soviet-Bloc Science Provided by High-Ranking German Physicist," Science, CXLIX (July 2, 1965), 40-42.

Heniz BARWICH, a high-ranking East German physicist who defected to the West, provided information on research and living conditions under the Soviets when he testified before the Senate Internal Security Subcommittee.


Denounces East Berlin Academy for having lost its integrity and for having become an instrument of the Communist regime.

POLAND


Comments on the period from 1920 to 1960 and the period 1961-1966 on the organization and expenditure on science.


Compares Polish expenditure on R & D with that of other countries. Also includes A Comment. . . by Christopher FREEMAN encouraging further comparative studies of this kind between Eastern and Western European countries.


Report of a visit by an American physicist.

Report of a visit to scientific and academic institutions in Poland.


Report of a British engineer's visit to Poland.

RUMANIA


A history from the 16th century to W. W. II.

YUGOSLAVIA


Tables and discussion comparing the magnitude of research effort of Yugoslavia with that of other countries.


Discusses the roles and structure of the Federal Council for the Coordination of Scientific Research (FCCSR).


The development of a national science policy and the organization of science from before W. W. II to the present.


Describes the research institute for nuclear physics, chemistry, and biology in Yugoslavia.
5.2.8 PEOPLES' REPUBLIC OF CHINA


With improved agricultural technology, China would be able to feed herself.


Such characteristics of leading Chinese scientists as age, education, and background, and their occupations and relations with the Communist Academia Sinica.


Reprint of an article from the Chinese journal, Scientia Sinica, (Vol. 8, No. 10, 1959).


Comments on the nature and organization of Chinese science by an Australian astronomer, based on his experience as an advisor to the Chinese Academy of Science in Peking.


The Chinese development of nuclear weapons and the world-wide implications.


The events of the ten years preceding the explosion of the first Chinese atomic bomb.


A favorable picture of scientific progress in China.


Considers the Chinese bomb test an indicator of the state of Chinese science and technology.


The political implications of Communist China's having the nuclear bomb.


The significance of the Chinese nuclear explosion and the timetables of nuclear bomb development in several countries.


Observations made during three visits to Communist China, noting rapid advances in science and technology.


Observations of the training of scientists in China.

NASH, Ralph G. and Tien-hsi CHENG. "Research and Development of Food Resources in Communist China," BioSci, XV (October, 1965), 643-656.

(Continued in November, 1965 issue, 703-710.)


Report of a British scientist's visit to China in 1952, describing the Chinese National Academy, the universities, and progress in public health and research. (See also idem., "Chinese Science Revisited (2)," Nature, CLXXI, February 14, 1953, 283-285, in which the practical tasks, teaching, and popular enlightenment currently emphasized in Chinese science are reviewed.)

Science in two southeastern provinces of China before the Japanese overran that area in 1944.


The explosion of the Chinese bomb revealed much about Chinese technology and the implications that China is possibly further along the road leading to hydrogen bombs and electric power-producing reactors than anyone thought.


Science programs in universities and research institutes and progress in manufacturing scientific instruments. Notes the pervasive influence of party politics in the scientific field.


What a British chemist observed during a tour of universities and research institutions in China.


A Japanese analyst reviews China's technical goals and the extent of her progress.

5.2.9 JAPAN


A controversy which resulted in the Japanese Ministry of Education issuing a set of stringent regulations governing the acceptance of overseas grants by Japanese national universities.


Symposium report of the AAAS Conference, December, 1963 at which Japanese scientists gave a comprehensive account of outstanding progress and achievements in their country.

Describes the Science Council of Japan and the national plan drawn up by it.


Describes six centers which are able to achieve their results because they are established on a permanent local basis and are supported mainly by the local boards of education.


Outlines development since the late 19th century, showing role of government and foreign influences on Japanese education and science and describing reconstruction program since W. W. II.


Science in Japan after W. W. II is described in considerable detail.


The rapid growth of industrial research and problems inherent in research management by Japanese industry.


The historical development of science in Japan, concluding that for maximum development, science must be free and international.


Japanese research and development activities in terms of resource and manpower allocations, goals, science policy issues, and the institutions within which science policy is made and implemented.

An historical account of development of science in Japan, its present organization, and its distinctive characteristics.


Includes: From Hydropower to MHD, by S. WADA and M. YAMAMOTO; Nuclear Energy: The Next 10 Years, by H. MURATA; The Growth of Steelmaking, by M. YUKAWA; Applying Chemical Research, by A. MISONO; Electronics and Telecommunications, by Y. DEGAWA; A National Model for Computers, by K. NODA; Lessons of the New Railways, by H. SHIMA; Microscopy: A Cooperative Effort, by B. TADANO; His Imperial Majesty's Hobby, by D. FISHLOCK; Milestones and Statistics, by T. MURAMATSU.


5.2.10 NEW AND DEVELOPING NATIONS
5.2.10.1 GENERAL


In new countries there is a chance to develop a scientific culture which integrates the scientific and the literary positions.


Suggestions for reducing costs, accommodating to the labor force, and accommodating to available resources in adapting technology.


How an underdeveloped country can best utilize the world pool of scientific knowledge and technological achievements.

Describes the introduction of modern science into any non-European nation by using a three-stage model.


Some of the problems encountered in India which may also be found in other underdeveloped countries, such as the lack of a good administrative setup for science.


Considerations for national policy in using science and technology.


Suggestions for formulating national policy in science and technology by the new nations.


A comparison of technological progress in different parts of the world and advice that the developed nations share their skills and prosperity with "have-not" nations.


Although the "have" nations provide training for the economic progress of the "have not" nations, they also tend to draw off these trainees for their own permanent use by offering them higher salaries than they could get at home.


The advantages of cooperative systems for the developing countries.

The costly results among underdeveloped nations of the belief that all countries must have a nuclear research program.


The problems of research development and scientific freedom operating against political ideologies in small underdeveloped countries. (See also idem., "Research: The Motor of Progress," BAS, XVIII, June, 1962, 4-7.)


The weaknesses of science in the many underdeveloped countries and the procedures by which the governments concerned can begin to develop an appropriate social structure and policy for science.


Steps to bridge the gap between developed and less-developed nations could include more capital available to the latter, careful national planning, and regional cooperation.


Comments on the Role of Science in the Advancement of New States according to the conclusions reached at the conference by this title held at Rehovoth, Israel.


Reasons for the economic backwardness of many developing countries and remedial steps to be taken.

FRONTARD, R. "Standardization in Developing Countries," Impact, XII (No. 4, 1962), 279-300.

How standardization helps in the solution of major economic problems.

International collaboration as an answer to harnessing the types of energy in these areas.


Need for bodies to formulate and implement science policies which coordinate research with national economic and social development.


Fifteen articles on the social and economic consequences of technological modernization in the developing nations.


A British view of standards and requirements for educating engineers, doctors, agriculturalists, and others in poor countries.


The conditions required to achieve self-sustaining economic growth.


Review of a report from the U. N. Advisory Committee on the Application of Science and Technology.


Substance of a paper by the director of the East African Trypanosomiasis Research Organization.
MALECKI, I. "Some Problems Concerning Organization of Scientific Research in

Comments, with reference to Polish experiences and personal observations,
or the best ways of advancing scientific research and organizing research
centers in developing countries.

MASON, Edward S. "The Planning of Development," Sc i Am, CCIX (September,
1963), 235-244.

Technology alone cannot insure development; it must be put to effective
use through wise planning.

MITCHELL, Robert Edward. "Barriers to Survey Research in Asia and Latin Ameri-

A description of the organizational, methodological, and ideological
obstacles to a healthy development of survey research in Asia and Latin
America.

MORAVCSIK, Michael J. "Fundamental Research in Underdeveloped Countries,"

Basic as well as applied research is important in underdeveloped countries
and visiting scientists from the West can make a real contribution.

---, "Technical Assistance and Fundamental Research in Underdeveloped

Reasons for the support of fundamental research in underdeveloped coun-
tries to help provide a fund of knowledge and personnel upon which applied
research can be based. (See also idem., "Some Practical Suggestions for
the Improvement of Science in Developing Countries," Minerva, IV, Spring,
1966, 381-390, in which problems arising from graduate education abroad
and from the isolation and low morale of scientists in the developing
countries are discussed.)

PIRIE, N. W. "Science and Development," Pol Q, XXXVIII (January-March,

Three problems of developing countries: how to find scientists and educate
them; how to keep them from emigrating; and how to encourage them to do
useful work for their country.

Suggests that associateship schemes be adopted by prominent Western universities to bring scientists from developing countries for regular periods of work after the example of the International Center for Theoretical Physics in Trieste.

SCHENCK, Hubert G. "Impact of Science in East Asia," BAS, XIV (September, 1958), 273-275.

Points to the relations among science, technology and society in describing Far Eastern progress.


The necessity and difficulties of implanting scientific culture in emerging nations.


A British chemist urges further study of the resources of the colonies, the development of industry as well as agriculture, and the applications of chemistry to colonial development.


For economic reasons underdeveloped countries should be encouraged and assisted in solar energy research and discouraged from atomic research.


The necessity of proper organization and time-targeted teamwork if R & D is to have a maximum effect on the economy of the country. (See also author's article, "Problems of Research Management in Developing Countries," ibid., X, July, 1967, 229-239.)


The inevitability of changes in social relationships when a nonmachine society becomes industrialized.

Local talent in developing countries should be directed to research on their own national problems.


The true value of costly nuclear reactors in the underdeveloped countries.


Cultural and religious implications.


Describes the value of a nuclear power station in India.


The astrophysical work at this observatory in India.


The first atomic reactor in Asia, outside the Soviet Union, was built at Trombay, India, in 1956.

Results of a survey of research in 25 industrial establishments from 1955 to 1962.


Homi J. BHABHA, chairman of India's Atomic Energy Commission, discusses India's plans for development through technology, with atomic power playing a needed role.


The Indian Institute of Technology at Bombay set up with Soviet aid as one of five regional technical institutes offering undergraduate and postgraduate training.


The contribution of Europeans in India between 1757 and 1857 and the reasons for limited interest in Western science among the Indian people.


The establishment and program of India's first national laboratory.


More support for science and greater freedom from menial tasks, red tape, and other frustrations suggested.


The Damodar Valley Corporation to provide power in Bihar and Bengal.

"Memorandum submitted to the Review Committee of the Council of Scientific and Industrial Research on National Research Laboratories by the Institute of Political and Social Studies."


Substance of articles from the Economic Times (Bombay) of November 19 and 20, 1963.


The opening ceremony of this institution in India, its aims and fields of research, and its finances.


Discusses reports issued by the Council, which has operated since 1942.


The need to create attractive conditions in which the younger generation of Indian scientists can develop their talents and work for their own country instead of remaining abroad on completion of their studies.


The kinds of technology India needs to import and encouragement for the development of indigenous science.


Reports on an investigation of expenditure, personnel, and research output.

A survey to examine the historical development and activities of the societies and their financial condition.


Although present-day scientific progress in India is satisfactory, it is likely to be retarded in the future by the anti-scientific forces of traditionalism.


Balanced development of agriculture and industry is essential for India’s progress and must be planned nationally.


India’s contribution to science historically and today.


An Indian geologist explores the efforts of his government to encourage research by establishing national laboratories, and surveys the role of Indian universities in supplying trained manpower.


Planning for an adequate supply of technically-trained personnel in India.


5.2.10.3 ISRAEL


The problems of science in a small nation and some of the contributions it can make to counterbalance autarchic tendencies in the science of large countries.


An Israeli scientist suggests, from Israel's experience, policies which would aid underdeveloped countries to utilize modern science and technology.


Israeli success with using techniques to use salt water for irrigation.


Discusses science in Israel.


The origin and operations of Israel's noted research institute.


Describes Israel's great research institution.


The importance of applied research to the Israeli economy and water resources, and paradoxically, the strength of basic research.

The structure of science in Israel, obstacles to its growth, and alternatives for executing science policy.

5.2.10.4 LATIN AMERICA


Problems involved stem from cultural traditions, social and economic environment, and defective educational systems.

FISHBEIN, Morris. "Medical Education in Latin America," JAMA, CXXXVII (May 1, 1948), 8-16.


Report of a regional meeting arranged by UNESCO.


The historical processes which gave rise to the development of science in the advanced countries did not take place in a systematic and sustained way among today's underdeveloped countries.


The development of science in Venezuela, the favorable and unfavorable aspects of the social climate, and the need for a national coordinating body for science.


Ways in which science can most effectively spur economic growth in Chile.

Comments by a North American physicist on physics research at universities in five countries.

5.2.10.5 NEW AFRICAN STATES


Evaluates the Lagos Plan for research development in Africa.


Describes a new college offering courses in engineering, pharmacy, teacher training, commerce, and agriculture.


Describes a new college in Nairobi.


The state of science, and medicine in particular, when the Congo became independent.


The Ghana Academy of Sciences is the coordinating body for research. The main scientific objectives are research in agriculture, industry, and medicine, and science education.


Discusses the question: "To what extent does science need freedom, and what kind of freedom does it need, in order to flourish?"

"The problem of making science and technology effective instruments for accelerating economics and social development."


Reviews a survey by E. B. WORTHINGTON on developments from 1947-1951 and plans for the next five years.


Synopses of the papers presented at the symposium and a description of the characteristics of the Academy.


Education of scientists in Africa and the organizations and research institutes which require trained scientific and technical personnel.


The emergence of cotton as a key crop in Central Africa provides an example of the possibility that the transfer of skills and know-how by technical assistance may often be more valuable than monetary aid.


The Institute was set up in 1947 in the Gold Coast to devise control programs against virus disease and pests which attack a major West African crop.


The Liberian Institute, an international medical research center.

Scientific research in Africa with reference to its organizational problems and its potential.

--- "Research Services in East Africa," *Nature*, CLXII (October 9, 1948), 554-556.

Research organizations set up under the Colonial Development and Welfare Act of 1945.


The recent organization of science in Africa is being affected by political changes.

5.2.10.6 OTHER COUNTRIES

GREECE


The state of research in Greece and the work of a pilot team to study and recommend research policy.


Summary of an OECD inquiry into the efficacy of foreign technical assistance in helping Greek economic development.

KOREA


Describes the beginning of the Korean Association for the Advancement of Science on January 30, 1947.

A survey of the material and non-material problems of laboratory work in Korea, especially as they affect the Japanese system as compared with the then recently-introduced American system.

PAKISTAN


Report of the author's visit to the subcontinent, emphasizing the development of power resources.


Summary of the Commission's survey of scientific and technical resources in Pakistan and its science policy proposals.


The knowledge, wisdom and idealism of technical communities can help Pakistan acquire the skills to combat poverty. Includes statistics of national resources in the second five-year plan.


Artificial rain production and use of solar energy are two major schemes undertaken by UNESCO and the Pakistan Meteorological Service to develop the arid zones in that country.

PHILIPPINES


Increased development of industrial research must await further economic growth and new economic policies.
TURKEY


The Center for the Production of Science Teaching Instruments was established in Turkey as an OECD pilot activity designed to show developing countries how to overcome the lack of laboratory equipment and raise their standards of science teaching.


A new university in Turkey designed "to serve the requirements of the developing Middle East."

UNITED ARAB REPUBLIC


The educational and research institutions visited by the authors.


The purposes of the academy, which was founded in 1945.


The Aswan High Dam will provide desperately needed farm land and water for Egypt as well as hydroelectric power.
SECTION 6

LEGAL ASPECTS OF SCIENCE AND TECHNOLOGY

The implications of science for law become evident in the numerous areas in which scientific innovations require regulation and control. Many of these innovations have given rise to public policy concerns and many of the legal questions that they involve have as yet been unresolved. Materials in this section are largely concerned with the legal system of the United States, but references to law in other countries and especially to international law are included.

Only one journal of the group surveyed for this bibliography, Lex et Scientia, is primarily concerned with substantive areas of law. Additional related materials in this rapidly developing area of public concern, the interaction of science and technology with law, are to be found in the law journals.

The reader may find those categories of section 4 which are obviously relevant to categories in section 6 useful in enlarging his appreciation of the effects of technological innovations on society. Additional relevant materials more or less closely concerned with the implications of science for law will be found in section II.2, in which some of the interactions between science and ethics are discussed.

Questions of law regarding the initiation, organization, and administration of research and development programs have rarely been mentioned in the articles cited in this section. Other categories which include some materials in these areas are section 5 (e.g., 5.2.1.4.1, dealing with the United States Atomic Energy Commission), and section 10 (e.g., 10.4, in which some articles dealing with grants and contracts are cited).

6.1 GENERAL


The actual theft of research data and the consequences for industries. Urges severe criminal law for the research thief.

The legal concept of the theft of proprietary rights to knowledge is well recognized, as is the right to protection from such theft.


Report on "ways in which the National Crime Commission's Science and Technology Task Force has used a variety of quantitative approaches to study the operation of the criminal justice system."


Legal aspects of nuclear power development.


Proprietary knowledge has real economic value and must be protected as a corporate asset.


Problems of domestic law and policy posed by nuclear radiation.


The role of the legal profession in protecting society from the hazards of rapid technological advance.


"This survey was conducted to determine the status of state ionizing radiation laws and regulations in relation to their effects on health and medical practice."
Legal Aspects of Science and Technology


A member of the U.S. Atomic Energy Commission discusses the U.S. atomic energy law and problems of law and science in this field.


Explores "some of the differences in order to delineate more clearly the areas of potential collaboration between the lawyer and the behavioral scientist."


Secrecy and invention agreements exemplify the need of the corporate employer to protect himself from his own employees.

6.2 INTERNATIONAL LAW

6.2.1 GENERAL


The history and provisions of the Antarctic Treaty and future prospects for the cooperative development of the continent.


Scientific discoveries have influenced development of international law mainly by extending the jurisdiction of states, influencing the system by which such jurisdiction is exercised, and altering the conditions in which the law of war is applied.


TOMA, Peter A. "Soviet Attitude Towards the Acquisition of Territorial Sovereignty in the Antarctic," *AJIL*, L (July, 1956), 611-626.
Section 6

6.2.2 MARINE LAW

ANDREWS, John A. "Who Owns the Resources of the Sea?" New Sci, XVIII (May 9, 1963), 307-309.

Problems of international law regarding territorial waters, the high seas, and the continental shelf.


Discusses problems of delimiting boundaries in water areas and attempts to formulate principles and techniques that might be generally used.


Freedom of the high seas is threatened by unilateral claims to resources of the continental shelf.


Legal problems concerning the use of the sea and its resources cannot be solved without considering political, military, industrial, sociological, scientific, and economic aspects of the problem.


A Conference of the Law of the Sea Institute of the University of Rhode Island provided a forum for the Navy and those with fishing, oil, and mining interests in the sea.

Discusses the U.S. attempt to establish conservation zones in areas of the high seas where considerable fishing is carried on.


Reviews some of the problems of jurisdiction over submarine areas and suggests some lines of future development.

ALDWIN, Marjorie M. "Recent Developments with Respect to the Continental Shelf," AJIL, LXII (October, 1948), 849-857.

Reviews the actions of the U.S. and several Latin American nations in extending their sovereignty over the continental shelf and sea bed.

6.2.3 SPACE LAW


A system of international control would be advisable, but United Nations efforts to work this out have so far been fruitless.


"Text of the treaty on principles governing the activities of states in the exploration and use of space."


Discusses the application of existing international law to space activities.


Article by the Director, Space Research Institute, World Rule of Law Center.

A Soviet writer reviews Western opinions and presents Soviet views concerning internationalization of outer space.


Most of the technical problems for communications satellites have been worked out, but political questions remain, such as jurisdiction over domestic systems and ownership of earth-stations.


Attempts to clarify terminology which will be used in astronautical jurisprudence.


An international space treaty would bring about more rational progress in space exploration than the present competitive conditions allow.


Suggests some of the problems that are likely to arise in the use of outer space, and appraises "proposed organizational arrangements for control of activities in outer space."


The U.N. has set out general principles for the use of outer space, but the details need to be worked out in an international agreement.


Cooperative action in outer space both within the United Nations and among member countries.

Predicts legal problems that will arise as military uses of space become more feasible.

6.2.4 NUCLEAR ENERGY AND ARMAMENTS


This case points out some of the legal problems arising from the use of nuclear weapons.


A novel and uniform set of rules intended to guide decision on compensation for personal or property damage resulting from a "nuclear incident" in Western Europe.


An essential function of the European Nuclear Energy Agency is to work out supervision and protection measures for the handling, transport, and processing of radioactive materials.


Considers some of the legal problems of atomic energy use, domestic and international.
214 Science 6


A lawyer discusses the requirements for effective control of nuclear industry.


Legal aspects of the revised International Atomic Energy Agency system of safeguards to ensure peaceful uses of atomic energy.

6.3 PATENTS


Presents ideas on how restrictions on computer use of copyrighted material would protect authors, publishers, and users.


Describes the origins of the concept of patents, and the heyday of the patent and its eventual depreciation in value, followed and accompanied by the concept of know-how.


A survey by the Industrial Research Institute of its 140 member companies, based on calendar year 1956 data.


Includes benefits of taking out patents, requirements for the inventor, and the powers that the patent gives the holder of the patent rights.


Proposed patent legislation discriminates against the drug industry and, if passed, would destroy creative research.
Legal Aspects of Science and Technology


The patent system as it relates to industrial and non-industrial research laboratories.


Discusses U.S. patent law and the proposed revision.


Introductory Report on Scientists' Rights prepared by the UNESCO Secretariat. Extensive bibliography.


Information retrieval at the Patent Office is becoming more difficult because of the lack of data process development in the patent system.


Discusses the need to revise British patent law to accommodate advances in science and technology.


Discusses the primary function of the patent system, government policy regarding inventions, and atomic energy patents.

Discusses the Federal Inventions Administration Act, S. 1176, and argues that license policy is preferable to title policy.


Argues that the courts have in practice found a stable balance between patent laws and antitrust laws. Extensive bibliographic footnotes.


Discusses the importance of patent protection in inducing inventive activity in the U. S.


Discussion of copyrights, patents, right to credit, duties of scientific administrator regarding scientific property, and legal protection.


Gives a critical summary of the conclusions of the report.


The problems of legal protection of "property rights" in ideas, including the question of patents.


The proprietary rights of universities in patentable items and research and in development resources.
Legal Aspects of Science and Technology


Discusses legal obligations and rights of employed inventors. (See also Idem., "The Employed Inventor-Part II: The American Situation," 243-265 of this issue.)


Discusses the patent policies of medical schools.


Discusses the Administration bill designed to simplify the patent system and key the U. S. to worldwide patent systems.


The experiences of patent-handling bodies in several countries and how these experiences may apply to Australia.


Argues that patent equity is essential to justify the expense of research in the pharmaceutical research laboratory.


Describes the usefulness of the patent system as a link between the discoveries of the scientists and their application for the public good.


The problem of the disposal of patent rights in inventions produced by government-financed research and development.
6.4 BIOMEDICAL


The origin and application of the Nuremberg Code as a standard for scientists in experimentation involving human subjects.


The need for changing U.S. abortion laws.


Discusses legal, moral, and medical aspects of the problem and offers some partial solutions.


Recent Congressional action has imposed severe restrictions on scientific research which might improve human life without substantially bettering the lot of laboratory animals.


Medical techniques which can maintain heartbeat and respiration after these functions have failed invalidate traditional definitions of death and create new problems for law and medicine.


Reviews the reactions of biologists to proposed federal legislation to regulate the use of animals in research.
Legal Aspects of Science and Technology


Briefly describes American and international law in this field.


DOWLING, Harry F. "Human Dissection and Experimentation with Drugs," JAMA, CCII (December 25, 1967), 72-75.

Compares the problem of drug trials on humans with the historic controversy over cadaver dissection and urges sensible legislation.


Injury to the laryngeal nerve is a possible occurrence in thyroidectomy. Some preventive measures to be taken by the physician to avoid malpractice suits and the need to lessen the frequency of legal actions brought against the medical profession.


Discusses current problems of professional liability and medicolegal testimony.

KUMMER, Jerome M. and Zad LEAVY. "Therapeutic Abortion Law Confusion," JAMA, CXCV (January 10, 1966), 96-100.

A discussion of the incidence of abortion in the U. S., present laws and their background, and recommended modifications.


Society's handling of the problems created by the pharmacological revolution of the last quarter century leaves much to be desired.


The roles of science and technology in the causation, control, and prevention of poisoning from the new mass drugs...alcohol, narcotics, and the psychedelic drugs.


Summarizes hazardous fields and lists principles of prevention.


SEEVERS, Maurice H. "Perspective Versus Caprice in Evaluating Toxicity of Chemicals in Man," JAMA, CLIII (December 12, 1953), 1329-1333.

Discusses legislation regarding food additives and other chemical products and suggests basic principles upon which to base evaluation of toxicity.


TIETZE, Christopher and Hans LENFELDT. "Legal Abortion in Eastern Europe," JAMA, CLXXV (April 1, 1961), 1149-1154.

VISSCHER, Maurice B. "The Congress and Animal Experimentation," JAMA, CXCVI (June 20, 1966), 1053-1054.

(See also idem., "Medical Research and Ethics," JAMA, CXCIX, February 27, 1967, 631-636, in which the morality of experimentation on animals is discussed.)


History and present provisions of anatomical laws.
Legal Aspects of Science and Technology


The need for positive legislation to support medical research.


A physician may claim a specialization without being hindered by governmental regulations.

6.5 LOYALTY, SECURITY, SECRECY


Traditional attitude toward security in scientific matters, based on the mistaken view that security measures safeguard large amorphous categories of information, is criticized and a more positive approach is advocated.

Special Committee on Civil Liberties for Scientists. "Civil Liberties of Scientists," Science, CX (August 19, 1949), 177-179.

Summary report of the committee's findings.


Secrecy, specialization, and simplistic approaches are examples of social and political pressures that break down the integrity of science.


Since the scientist must explain his work to a wide public, too much secrecy frustrates decisions about science and may also frustrate scientific development itself.


Argues against U. S. policy of denying research grants for unclassified research to scientists whose loyalty may be seriously doubted.
FELD, Bernard T. "Let's Abolish Classification in the Atomic Power Field," BAS, XI (June, 1955), 219-220.

Points out advantages of declassification.


The classification of scientific and technological information has hindered the participation of industry and therefore classification procedures should be revised.


The advances in research and technology made secretly during W. W. II, which information must now be disseminated and reconverted to peaceful uses.


New security regulations proposed by the Atomic Energy Commission raise a threat to academic freedom and free scientific inquiry.


Statement before the House Subcommittee on Government Information on the availability of scientific and technical information.


Policy is to protect vital secrets of atomic science affecting national security and to disseminate basic mathematics, chemistry, and physics developed by the project during the war.


Reviews sections of the McCarran-Walter Act relevant to scientists, particularly those excluding foreign scientists from visiting the U. S.
Legal Aspects of Science and Technology


Discusses the security problem in the U. S. as it affects scientists and suggests a re-evaluation of the meaning and purpose of the security program.


The formation of policy for declassifying scientific information and the procedures which are followed.


Although this was a problem currently of much concern to scientists, scientists as such are not mentioned in this article, which reviews previous restrictive legislation.


Describes new developments in the Soviet Union and the U. S. which call for modifications in security measures.


Reviews and criticizes the policies of the House Moss Committee on Government Information Policies on secrecy problems in science.

ROSEBURY, Theodor and Melba PHILLIPS. "Two Aspects of the Loyalty Problem," Science, CX (July 29, 1949), 123.

Criticizes loyalty oaths required by applicant's for federal science grants, and states loyalty is to one's country and not to institutions or elected officers.


Discusses Committee's work with the immediate practical problems facing scientists.

The benefits of free exchange of scientific information and the conditions under which secrecy is essential.


Technical problems faced by chemists engaged in atomic research and the relation of science and security.


Freedom of science, once taken for granted, is now being reduced through the demands of national security and loyalty oaths.


6.6 ENVIRONMENTAL CONTROL


The chemical industry's view that air pollution control should be left to local authorities.

DIXON, James P. "For Air Conservation," BAS, XXI (June, 1965), 7-12.

Calls for air conservation as an objective of public policy.


Discusses recent legislation and technological advances relevant to the problem of aircraft noise.


Federal involvement in pollution control has increased greatly in twenty years. (See also idem., "Congress Takes a Hard Line on Air Pollution," EST, I, February, 1967, 119-123, which describes proposed Congressional legislation on air pollution, and idem., "Air Quality Act of 1967 Now a Matter of Fact," EST, I, November, 1967, 884-887, in which the provisions of the new legislation to control air pollution are discussed.)
Legal Aspects of Science and Technology 225-226


"Only in the 1960's have we started to enact comprehensive legislation to give the government the power to save our remaining water supply."


A control system that effectively combines many measures and urges the use of regional water management agencies in order to abate pollution.

LESTER, A. P. "River Pollution in International Law," AJIL, LVII (October, 1963), 828-853.

There is need for an elaboration of international law to govern cases of international river pollution.


"The proposed Air Quality Act of 1967 is an unprecedented opportunity for the business community to carry out its responsibility for controlling the growing problem of air pollution in this country."
SECTION 7

EDUCATION AND PUBLIC UNDERSTANDING OF SCIENCE

Topics dealt with in section 7.1 include public attitudes toward science and scientists; the increasing requirement for public understanding of science as it relates to social and political concerns; and the role of science in general education.

Section 7.2 cites articles concerned with the role of science education in general higher education; many of these emphasize the social contexts of science and technology and the necessity for the integration of science in "liberal education." But many aspects of education are found in other sections of the bibliography. Articles dealing with the education of scientists and engineers will be found in section 5, and especially in section 8.2. Additional related materials on the impacts of science and technology on universities, and research and development activities in universities, will be found in sections 5 and 10.4. Section 11.1 cites some articles dealing with relationships between the sciences and the humanities in higher education.

Section 7.3 deals with possibilities of increasing the public understanding of science through other channels than formal educational systems. The use of the mass media to convey and interpret information about science to the general public is discussed, as are some of the problems of popularizing science.

7.1 GENERAL


Is the citizen in a democracy capable of fulfilling his functions in the complexity of scientific society?


The advancement of science depends upon investment in the education of man.

The kind of knowledge and understanding of science and technology needed in education for life in the scientific culture.


Urges that science become central in the system of education as a corrective to excessive verbalism and imprecision.


The best means of accurately disseminating information on scientific fact and method.


Faults of the traditional non-scientific education are analyzed and criticized, with suggestions that all citizens have some experience with science and be familiar with its language.  (See also idem., same title, Adv Sci, XII, December, 1955, 301-306.)


Deals with overspecialization within science itself, its divorce from the humanities, and its incomprehensibility to the public with the political consequences this attitude brings.


The scientist and educator bear special responsibility for shaping man's future in coping with such problems as population growth, conservation of natural resources, and putting an end to war and violence.


The first job of scientists is to explain the world to the layman by the use of facts and a coherent philosophy to contain the facts.

Education in science and the meaning of progress in relation to science, with recommendations for a wider diffusion of an understanding of science by all citizens. Extensive bibliography.


The historical approach to science can give a better understanding of it to those who will mold and lead society.


The intellectual climate in which children live may lead to better science teaching.


Criticizes scientific reports to the public for their extreme brevity, inconclusive evidence, and for being directed by commercial interests in areas of science having a direct bearing on society.


The field of human relations, not science and technology, is most important for national survival.


Various aspects of the relationship between science and the press.


Examines present social attitudes toward the scientist and compares them with earlier attitudes.


A program for studying the relation of ideas and public opinion, using Darwinism as a model.
Section 7


The growing impact of science challenges educators to impart interest and knowledge of an expanding subject in a minimum length of time.


Because of the inert, uninformed general public's political power, dangerous policies are being followed to the exclusion of intelligent alternatives.


Attitudes towards knowledge-seeking enterprises, from ancient times to the present.


Although the humanists control the direction of society, it is the scientists and technologists who make the greatest contribution to it.


Science occupies a dangerously narrow place in our culture and too few understand it properly despite the vast number of present-day scientific achievements.


The interactions of science, government, and the public which have resulted from improved communications.


Reviews some of the factors which limit achievement in science and education in the U. S.


Challenges presented to secondary and higher education by the fact that we live in an "age of science."
How science will influence the mind of man in regard to his outlook on life, his attitude toward people, and his self-understanding.

LONSDALE, Kathleen. "Scientists and the People," BAS, XIV (September, 1958), 242-245.
A commentary on the scientist's public image and place in society.

As human problems become more interwoven with science and technology, a rough idea of natural philosophy is becoming a "must" for liberal education.

The various aspects of educating the non-scientist citizen to understand the purposes and methods of science.

Man's new-found ability to influence life procedures makes understanding of biology imperative.

It is important for citizens to understand science because it is concerned with the means of life.

The importance of rectifying public misunderstanding of science practitioners through using communication to increase the public's understanding and attention to semantics.
Editorial introduction to a symposium with this title.

ROSSI, Ennio C. "Why Is the Medical Profession Estimable In the Individual But Not In the Generality?" PBM, VIII (Winter, 1965), 230-240.

Ways of spreading the scientific spirit through education and the involvement of laymen in scientific research.

The need for education and the place of science in a liberal education.

Gives long list of practical problems which require scientific understanding by the ordinary citizen.

Four aspects of the problem of interpretation of science.

Assessment of public attitudes shows the need for greater public understanding of science.

7.2 SCIENCE AND TECHNOLOGY IN HIGHER EDUCATION

"Substance of an address delivered... at the Rockefeller Institute...", dealing with the place of teaching and of research and with the dangers of state direction.

The causes of this shortage and their solutions.


Argument for increased involvement by universities in national and regional economic development.


The historical relationship between universities and medical schools and comments on the present situation.


Universities should organize a unified approach to all pure and applied physical science.


The American system of land grant colleges should set an example for the endowment of enduring British colleges and universities.


The need for management and administration of our rapidly advancing science and technology as a challenge to universities and government.


Need for science in liberal education and the five essentials of the minimum core of scientific education.


Describes a successful program in experimental biology at Wilkes College.

Ways by which colleges may help the public obtain a better understanding of the methods and significance of science.


The universities in the U.S. have a duty to make clear the differences between science and the products of technology.


Universities assist American industry in consultation, research, and special educational programs, to the benefit of both.


Five areas in which the university impinges on social science.


"Science is . . . the core of a truly liberal education," and the strength of a nation lies in its science.


The successes and failures of a training program for high school sciences and mathematics teachers.


The history and contributions of the Massachusetts Institute of Technology.


Supports a technological rather than a pure science university training for producing technologists.

The university should always be the haven of the free and individualistic scholar who is uncommitted to any objective but his own.


The barriers of departmental lines can be overcome in the autonomous institutes for research and instruction.


The problems to be overcome by and the values to be derived from an international university, particularly in the sciences.


"Spinoff" businesses, formed by graduate students and professors to capitalize on the results of university research, are economically and socially promising.


Describes how institutions have joined forces to foster the application of the burgeoning information science to higher education.


Describes a proposal at Cambridge University to combine principles of science with the arts course.


Problems of science course design for general college education. How can we safeguard the good name of science? How can we give the general public a real understanding of science?

Discusses pressure for large scale research and the role of the public health service, and suggests policies for administering grants.


The case for this new method of teaching science.


The research park is seen as a way of fostering important and useful interactions between the university and a techno-scientific society.


The president of a small college urges tailoring contracts and grants to the purpose of the institution and its resources for research.


Stresses need to support men, not projects, and the need for a greater understanding of the nature of basic research.


Value of a separate department or independent institution for teaching the history and philosophy of science and possible programs.


The past and present relations between industry and academia, with examples such as catalytic reactions, radio astronomy, and nuclear science.


An Austrian physicist argues that the traditional European educational system of narrow training in recognized academic disciplines is insufficient to safeguard our civilization and suggests changes.
Education and Public Understanding of Science


The impact of government support of research in the lack of support for basic, undirected research and for teaching.


Teaching, and particularly undergraduate teaching at large universities, is being neglected because of emphasis on research.


Describes an experimental course at the University of Utah.


Authors refute the criticism of the modern American system of education made by Harry J. FULLER in the January, 1951, issue, pp. 32-41.


The necessities for an intellectual education in a "cybernating society" and the need to begin changing higher education at once.

7.3 SCIENCE WRITING AND POPULARIZATION OF SCIENCE


The British Association in collaboration with the Royal Society recommends establishing an Institute of Scientific Information to be supported partly by private and partly by public funds.
The problems of scientific education for the public.

The future of science depends on effective communication between the scientist and the layman and among scientists themselves.

The need for popularized books on science and the work of university presses in this field.

Poor communications between scientists and non-scientists underlines the need for clear writing and specialized book reviews, based on their intended audience, are needed.

An answer to Philip Wylie's article in Vol. IX, June, 1959 (pp. 12-15) about the scientific literacy of biologists and laymen.

The popularization of natural history by the curiosity museum and the circus.


Suggestions include presenting members of one branch of science to those in other branches and science presentation to persons of little or no scientific background, such as politicians.

Some of the unreasonable suspicions which the non-scientist may harbor about science.
Problems are training competent reporters; popularizing atomic news; dispelling public fear and ignorance; and guarding national security.


Intelligible scientific communication is essential for correct and wise application of scientific discoveries.

"Presentation of Science to the Public," CEN, XXXII (April 19, 1954), 1590-1593.

How to add color, find the simple simile and the analogy of the commonplace, and other techniques useful in presenting scientific material to the public.


The training needed for science writers, desirable personal qualities, and the use of language which the public can understand.


Science reporters are not doing well enough and scientists and science agencies often fail to help.


A science writer discusses his work and makes suggestions for effective science reporting.


The activities of Science Service in reporting science through news releases, publications, and youth programs.


"Public apprehension and hostility point to the need for an enlargement of science" to make it more relevant to human experience.

An overview of the profession, its importance to the public, and measures for expanding and improving training for science writers.


Commends the increasingly close relationship between scientists and the press.


The history of popular attitudes toward science and technology and the growth of a "popular science" to meet the requirements of the population for knowledge which "official" science is too remote to supply.


Industrial magazines have contributed fresh insight to the communication problem. Effective stylistic devices to aid the lay reader are suggested.


Responsibilities and opportunities for chemistry's fourth estate lie in better understanding between scientists and the public.


Public opinion surveys in 1957 and 1958 released by the National Association of Science Writers show a direct relationship between science education and the assimilation of science news.


Report of survey of science news reading habits and a discussion of the adequacy of science news reporting.

The popularization of science, begun in France at the end of the reign of Louis XIV, can be traced in the propagation of the French Revolution and the founding of Western democracies.


Popular science writing should be interpretive.


Science writing has progressed to the straight news reporting of the computer age.


Asks how well the press has fulfilled its responsibility to inform the public fully on matters pertaining to atomic energy.

MEAD, Margaret. "Closing the Gap Between the Scientists and the Others," Daedalus, LXXXVIII (Winter, 1959), 139-146.

Suggests the communication of scientific advances to children as a means of creating a truly scientifically literate society.

METZNER, Charles A. and Julia B. KESSLER. "What Are the People Thinking?" BAS, VII (November, 1951), 341-352.

Summarizes findings of a survey of public interest in atomic energy.


Criticizes "semiscientific popularizers of science who disseminate what they clearly do not understand."

An introduction to 10 science articles addressed to the layman.


Outlines some methods which, if applied more widely, would popularize science.


Discusses importance of style and honesty in popular science writing and the usefulness of science history for popular understanding.


The new task of science popularization is "to educate mankind for living in the new world created by the scientific revolution."


A meeting of the (British) Scientific Publications Council considers the problems and quality of science popularization.


"Lifts science out of the atmosphere of the cauldron and gives the unspecialized public insight into its workings."


The problem is communication: how to say it correctly, interestingly, and intelligibly.


A science writer discusses the importance of communicating scientific developments to the public.

Museums as a means of interpreting science to the layman and suggestions for their organization.


Specialization among scientists, along with their dislike of amateurs, is building up a barrier for the layman who should have some knowledge and appreciation of science.
SECTION 8

SCIENTIFIC AND TECHNICAL PERSONNEL

Section 8.1 contains materials on the roles of scientists in their professional capacities and in society. Support for scientific and technical activities has often carried with it responsibility for increasing integration of these activities with those of the society in which the scientist functions. Several articles in this section deal with one aspect of this responsibility, the need for some scientists to accept administrative duties. As the scientist functions as part of a wider social environment, there are tendencies to "professionalize" his status and role by, e.g., certification of his professional competency, or explicit delineation of his responsibilities and duties within an organization. Related materials concerning the social roles of scientists will be found in section 12.2. Articles discussing public images of scientists are cited in section 7.1.

Section 8.2 cites articles on the education of scientists and technologists. Although several educational programs are discussed, most of the articles fall under two broad categories: the integration of scientific and technical training with liberal education; and continuing studies to avoid the obsolescence of scientific and technical knowledge. Additional related materials will be found in sections 5.2.1.3, 5.2.1.4.2, 5.2.1.4.3, 5.2.2.2, and 5.2.6.2.

Section 8.3 is concerned with problems of evaluating the quantity and quality of scientific and technical personnel. Much of the material in this section concerns the United States. Manpower studies in other countries will be found in section 5, especially in 5.2.2.4 and 5.2.6.3.

Section 8.4 is directed primarily toward professional organizations in the United States. Related materials will be found in 5.2.2.3 and 5.2.6.1.

Section 8.5 cites articles dealing with such topics as the personality and aptitudes of scientists; scientific creativity; predictive indicators of scientific ability; and the functioning of scientists and engineers in various social environments.

8.1 SCIENTIFIC AND TECHNICAL PROFESSIONALS

BEER, John J. and W. David LEWIS. "Aspects of the Professionalization of Science," Daedalus, XCII (Fall, 1963), 764-784.

The changing social status and role of the scientist and some of the pressures and problems he faces.

The traditional role of the scientist is inimitable to the exercise of political power which is today based on the accomplishments of science.


The involvement of a British man of science in government over a period of seventeen years.


Because of his Independence of thought, the scientist's main role is to achieve the knowledge which will help liberate mankind from his physical and mental ills.


Comments on the increasing scale and cost of scientific work and the growing burden of administrative responsibility of the scientist.


Men of affairs and social influence should learn more about science and more scientists should become administrators, particularly in higher level government posts.


The characteristics, privileges, and responsibilities of a profession and the development of collaboration during W. W. II between scientists and military men.


The suitability of women engineers, the associations functioning for them, and the qualifications they need for this field.

The place of the research worker in education, society, and organized research; his professional standing; and the most desirable research climate.


Three aspects of the experience of science are explored.


Discussion of unreasonable demands placed on scientists by American society.


Suggests that "no area of American life has been so radically changed by world events since 1940 as the world of American science and technology..." and that this has been the result of governmental employment and funding.


The physician's status today is higher than it has been during most of the history of the U.S.


Why men like the Australian scientist, David RIVETT, now exert a paramount influence on scientific research in all civilized countries.


Means of improving the administrative effectiveness of poorly qualified scientists promoted to major supervisory positions.


Now heavily supported by federal monies, the academic scientist is beginning to accept political responsibilities.
GRANZEIR, Frank J. "Should Scientists Be Licensed?" Ind Res, VII, No. 10 (September, 1965), 100-103.

Certification by a professional body may serve both to insure the scientist's rights and to upgrade his professional image.


A French scientist's observations on the training and working situations of U.S. scientists.

HASKINS, Caryl P. "Science and the Whole Man," Daedalus, LXXXVI (September, 1956), 113-121.

Trends in science-government relationships and the need to preserve the creative individual in an era of mass organization of science.

HEREIM, Andrew T. "Are Scientists Becoming Administrators?" Am Sci, L (December, 1962), 355A-360A.

The cost of retraining scientists as administrators, the ease of previous training, and the attrition of divided effort.


The significance of science and its social role, and the characteristics, mission, and responsibilities of the scientist.


The past and present situation of physicists and special problems created by society's applications of science.


Using VELIKOVSKY as an illustration, LAFLEUR defines a crank and discusses the wisdom or responsibility of the scientist to refute such cranks.

Since W. W. II many mathematicians have found prestige, status, and good positions outside the academic life as problem-solvers for government and industry.


A comparison of the community of scientists with a free society as a system of "independent self-coordinated initiatives."


The controversial origin of the term "scientist" in connection with the transition of science from an activity of amateurs to a profession.


Four articles from a symposium given at the 1953 annual meeting of the American Association for the Advancement of Science: Scientists and other Citizens, by Gerard PIEL; Science for Its Own Sake, by Victor F. WEISSKOPF; The Legal Basis for Intellectual Freedom, by Mark De Wolfe HOWE; and Scientists and Political Action, by E. C. KEMBLE.


Explores the question of "whether the intellectual activity of engineering has any reality in the pattern of human endeavour."


Remarks on scientists and the variety of their qualifications, activities, and accomplishments.


The character and training qualifications needed for a career in scientific research.
Remarks on the organization of science, the proliferation of papers, originality and creativity, and the social uses of science.

8.2 EDUCATION

Deals with the shortcomings of engineering education and the need for more and better engineers. Photographs and charts.

BRADLEY, Stanley E. "Medical Education and Medical Research - An Interaction," NEJM, CCLXIX (December 12, 1963), 1292-1296.

Preliminary work done in training future scientists in the Forest Hills High School, Forest Hills, N. Y., and states the need for a national program to further the best science teaching in high school.

The changing environment of engineering education and appropriate changes in the professional program.

CONANT, James Bryant. "History In the Education of Scientists," Am Sci, XLVIII (December, 1960), 528-543.
Argues that scientists may get valuable preparation for such non-science roles as administration and politics by studying the history of science.

An exclusively scientific education does not allow a man to attain the range of qualities necessary for enlightened leadership. A comprehensive study of man is essential.

Discusses research in medical education. (See other articles on the subject, pp. 432-454 of this issue.)


Teaching must aim for an ability to reason and participate and understand rather than a mere acquisition of facts.


Trends in science and the educational system in the light of current needs.


The features of institutions of higher education which encourage creativity in the sciences.

HAUSER, Ernst A. "The Importance of Science In American Education," Science, CXIII (June 8, 1951), 643-646.

Sees American scientific training as too specialized and technical, and stresses the importance of making students understand what science really stands for.


"Scientists are best developed in an environment in which science is being pursued as an exciting adventure, where the participants are eager 'to hear, to discover, and to tell some new thing.'"


Suggestions for school and university education, and the inseparability of teaching and research in the university.


The nature of engineering, its relationship to science, and the necessary attributes of engineering education.

The specific goals of engineering education and comments on quality of instruction, selection of candidates, and teaching methods.


The dangers of inflexibility in scientific thinking, and the need for revision of the teaching of sciences to include training in sophisticated thinking.


The need for a liberal rather than a specialized education for the scientist.


The influence of examiners and licensing bodies, private foundations, professional societies, and the federal government.


Considers reasons for shortage of scientists and blames it not only on educators, but on scientists themselves.


The changing tasks and broadening scope of engineering and the type of education that will be required for engineers in the future.


The importance of opportunities open for professional growth and the need to keep scientists in government and to improve their work.

Criticizes scientists' lack of appreciation of the social relevance of their work and places the blame on the universities.


Remarks on U.S. and foreign medical education, stressing the need to keep a balance between research and teaching, and between the laboratory worker and the clinician.


Suggests possible ten-week programs of fulltime study for technical personnel for updating technical competence.


An essential task of education is to build "a broad base of mutual understanding between all physical scientists and all social scientists."


The need for scientists to become involved in our technological society and some of the implications for education.


Trends and problems in graduate science education.


Results of a 1963 survey of company investment in educational activities to update scientists and engineers.


Report of survey of 69 federal agencies employing civilian engineers that carried on continuing programs to update engineering education.

The author's observations of several institutions in the U.S. with regard to courses, standards, research staff, and relations to industry.


Treats the scope of the philosophy of science and feels that a sound advanced course is essential for the scientist-student to enable him to view science as an integrated whole.

WEISKOTTEN, Herman G. "Lasting Values in Medical Education," JAMA, CLXIV (June 1, 1957), 533-537.

Answers some of the criticisms of medical education and cites progress during the 20th century. (Other articles on medical education, pp. 538-552 of this issue.)


Advocates an appropriately designed graduate course on scientific writing which could strengthen scientific thinking.

8.3 MANPOWER STUDIES


Recommendations regarding the mobilization of scientific manpower made to the Manpower Office of the National Security Resources Board.


Attempts to evaluate potential manpower supply by separating those portions of the population which, by reason of aptitude, sex, ability, or interest, tend to form a professionally-oriented student group.
Scientific and Technical Personnel


Recommendations by the Scientific Manpower Advisory Committee of the National Security Resources Board.


Practices in technical manpower recruitment may contribute to the more than 18 per cent of researchers dissatisfied with their jobs.


The positive aspects of migration and some implications for policy.


The problem of the migration of scientists from underdeveloped countries.


The shortage of U.S. scientists and engineers and the causes and possible solutions.


Manpower studies, with breakdown by fields of specialization.


Analyzes the types and causes of obsolescence.


The nature, extent and implications of "brain drains" from other countries and among institutions within the U.S.

Recommendations to the National Security Resources Board on the mobilization of scientific manpower.


Commentary on a symposium on "The Human Resources of the U.S."


The findings of the National Manpower Council on the nation's shortages and potential manpower.


Describes Executive Order 9791, a thorough study of the federal research and development program. Suggests federal action to increase supply of scientists and discusses federal government as an employer of scientists.


The tendency of scientists to migrate to the more highly-developed areas and how this may be controlled by making conditions in less developed areas attractive to scientists.


Factors favorable to and also those impeding the effective use of scientific manpower.

KUBICEK, Earl C. "Is There Really a Shortage of Engineers?" Ind Res, I, No. 3 (Summer, 1959), 76-80.

The effects of the "shortage" could be lessened by better personnel utilization.


The value of health manpower-distribution studies as a part of national and local programs to extend health services.
LEE, Philip R. "New Demands for Medical Manpower," JAMA, CXCVIII (December 5, 1966), 1091-1093.

Followed by other articles on medical manpower and education, pp. 1094-1109 of this issue.


Projects a number of variables and their effects to 1975 and suggests ways for decreasing the deficit of scientists and engineers in that time.

MEYERHOFF, Howard A. "Arms and Manpower," BAS, X (April, 1954), 119-120; 122.

Selective Service is faced with the problem of "maximum competitive demands for men with specialized training."


Discusses statistics from a study made by the National Science Foundation of the available supply of biologists and the demand in agriculture, industry, and the academic world.


The growing emigration of scientific and professional personnel to the U.S.


Gives information on the output of scientists in U.S. universities during the preceding 20 years.


Reports on scientific manpower supply and needs in Britain and in several other European and American countries.

Traces the growth of American scientific manpower from 1940-1950 and urges maintaining a balance between supply and demand.


We are in a race for technological supremacy and consequently young people must be encouraged to take up scientific and engineering careers and must be given assistance in doing so.


As the result of the depletions of the ranks of scientists by the growing demands of military research, it is essential that women be encouraged to take up science, medicine, and engineering.


The part to be played by senior scientists in the mobilization of scientific manpower.


The problem of obsolescence for scientists and measures which may help solve it.


The six scientific advisory committees, representing agricultural and biological sciences, engineering sciences, humanities, the healing arts, physical sciences, and social sciences, review their recommendations regarding the mobilization of scientific manpower.


Description of the National Roster of Scientific and Specialized Personnel and its functions.

Recommendations for the mobilization of scientists. (See also idem., same title, Phys Today, IV (February, 1951), 18-24.)


Soviet education seen as service to the state. The high quality of Soviet technical education and the impressive incentives to education in science are noted.

8.4 PROFESSIONAL ORGANIZATIONS


Recommendations on education and the support of science, and on the organization and administration of science in government.


Theoretical discussion of the attributes of a modern state academy of science against the historical and cultural background.


Reports on the Federation of American Scientists, the British Atomic Scientists' Association, the New York Committee on Atomic Information, and the Council on Atomic Implications.


Experiences over 15 years at the Whiting, Indiana, refinery and research laboratory of the Standard Oil Company (Indiana).

The role of and qualifications needed by an executive secretary of a professional society.


A progress report by the director of the American Institute of Biological Sciences.


Description of a new organization for solving the problems of scientists in general.


The growing role of professional societies and organizations in functioning as "labor organizers." Prospects for unionism remain hazy.


Their history and organization.


The division concerned with international activities of the National Research Council and the National Academy of Sciences.


The character and activities of the organization.


(Continued in the April, 1951 issue, pp. 13-15.)

The Association of American Geologists expanded to include all naturalists and finally became the American Association for the Advancement of Science.


Early history, the advances in the 19th century, and the expansion and diversification of the Association in the 20th century. (See also ibid., "The AAAS and Organized American Science," in Science, CVIII (November 26, 1948), 573-577, which deals with the relationship of the AAAS to organized science.)


"In a 'prospect from retrospect' a biophysicist shows how a society bridges gaps within a discipline."


Reports on the Academy's influence during its first century.


Discussion of the origin of engineering unionism in Western Electric (1944-1945), and subsequent union-management relations.


A history of the U.S. National Academy of Science.


A brief history of the junior academy movement and its financial support and operation.

Section 8

8.5 SOCIAL AND PSYCHOLOGICAL STUDIES


Historical studies of age and scientific creativity.


Areas of satisfaction and dissatisfaction, relative advantages of government, university, and industrial work, and differences in attitudes among respondents.


Two studies relating to the processes of invention and innovation in current research and development.


Major types of awards used are those to recruit and hold employees and those to encourage the individual to his maximum creative effort.


Differences in productivity in France, Germany, Britain, and the U.S.


The factor explored in greatest detail is the Zeitgeist, or general climate of thought in which the investigator is trained and works.


Creative management and the wide use of incentives can turn a competent engineer into a creative innovator.


"The aim of this paper is to show how a group of professional scientists and engineers has met the partly conflicting demands of bureaucratic procedures, professional standards, and personal values."

Some of the factors that affect creativity in scientists.


The relationship between quality and quantity of scientific output and the degree to which each is influential in eliciting recognition.


Problems of scientists employed in industry and the stresses between individual creativity and organizational structure.


Uses publication and honors to measure the productivity and recognition of scientists, and concludes that there is a high correlation between these factors and the academic setting.

Daedalus. Creativity and Learning. XCIV (Summer, 1965), entire issue.

Articles on scientific and scholarly creativity.


The relative images of science and technology as seen by career-seeking youth.


Examples of creativity and genius in science, the influence of precursors, and the basic similarities between science and the liberal arts.


The kind of social setting and organization most desirable for the administration of science and the natural scientist as a social scientist working in a "communication system founded upon conventional agreements."


Fashions in science "condition professional appointments and allocation of research facilities; they tend to starve out and eventually to discourage investigators whose interests differ from those of the majority."


Methods used to induce superior technical results in science-oriented organizations surveyed by *Industrial Research*.


The success of organized scientific research comes from the organizations having been built and controlled by scientists. The organization should fit the worker first, corporate organization second.


Creativity in both science and art is measured and compared.


The development of an approach to the compensation of personnel in the General Electric Company.


R & D administration should be more concerned with the behavioral patterns of its researchers and with better skills in dealing with its people.


Report of a survey of the educational background of U.S. scientists holding the Ph.D. in the natural sciences.
Scientific and Technical Personnel


Variations in freedom in a health agency, hospital, medical school, and university.


Because of the costly nature of scientific research and the frequent need for funding from an outside source, it is possible that scientists may have to follow a sponsor's interests rather than their own.


A history of the Nobel prizes.


Results of 1952 study done by American University which describes questionnaire used to study employment decisions of students and factors shaping attitudes towards the two kinds of jobs.


The scientific ladder and the administrative or managerial ladder are not comparable because of intrinsic differences in function.


The growth of science, ancient and modern, reveals the creative role of the individual investigator.


Education for a research career is haphazard in most universities. Cites the dangers inherent in such personal factors as suggestibility and bias in favor of old beliefs and hypotheses.

Examples of self-frustration in science and administration, the principles of Impotence, and the dangers of formulating them without adequate experimental testing.


Discussion of a continuing and serious management function. Footnotes.


Management responsibility to acclimate new professional personnel.


"The scientist as a social type is strongly influenced by the institution in which he works."


Suggests that research be done on the distribution of creative productivity and the processes by which it becomes manifest or inhibited, in order to make education for scientists more effective.


Psychoanalytic studies of five general problem areas faced by the scientist in his career.


"Ladders" are unnecessary because scientists and engineers can achieve status and financial recognition through broad classification.

A study of the selection process and the aims of the Nobel Prize institution.


Effective thinking depends upon a balance of creative and critical functions which are social as well as individual in character.


Study of the quantity of scientific output in organizational and non-organizational settings.


Originality as one of the norms of science, the system of allocating rewards, and the pathogenic effects of emphasis on originality.


A sociologist considers the relationship of an individual man of scientific genius to the inevitability of discovery, an "hypothesis of multiples."

MICHAEL, Donald N. "Scientists Through Adolescent Eyes: What We Need to Know, Why We Need To Know It," Sci Mon, LXXXIV (March, 1957), 135-140.

A national survey should be taken to find out what is wrong with the scientist's public image, and what the young hope for their own futures and that of the world.


A study of several categories of research workers, their motivations, their influence over persons affecting them, and organizational atmosphere as it affects their performance.

Freedom is necessary to research only "in so far as it contributes to a wise choice of problems and to the enthusiastic and successful pursuit of solutions."


Psychological problems raised by cooperation of persons of different temperaments on scientific research teams.


Considers the conditions and consequences of contracts between leaders and coadjutors in a scientific research team.


Much of the dissatisfaction of scientists and technologists in industry stems from poor management.


Analysis of the factors involved.


Distinguishes between stereotyped and real scientific success and examines the goals of science when they conflict with the goals of the scientist.


A study of the attributes of biologists, physicists, and social scientists to determine whether special qualities of personality, mind, intelligence and background are required in such occupations.


Social and psychological influences restrict women's choices and the pursuit of careers in science.


Discusses approaches developed at the American Cyanamid Company.


The Nobel Prize has been a meaningful form of recognition for scientists and has served as an inspiration to the creative mind.


The traditional method of research compared with the new dependence upon costly machines and 'production line' operation.


British scientists' salaries are surveyed by field of employment and by rank and position within each field.


Psychological and sociological description of the research scientist.

SEIFERT, H. S. "Can We Decrease Our Entropy?" Am Sci, LXIX (June, 1961), 124A-134A.

Ways in which universities and professional societies can increase creative effort in science.


A study by the Bureau of Labor Statistics which indicates that most scientists' primary job requirement is challenging work in their own fields.

Reviews major research programs. Extensive bibliographic footnotes.


Report of a study of the communication system in an applied research group.


Methods for the selection and encouragement of creative workers, the similarities and differences in the university and industrial research laboratory.


The law status of engineers in Britain and suggested improvements in their course of training.

SPRAGUE, Philip A. "Man As a Research Tool," Ind Res, IV, No. 6 (June, 1962), 52-56.

The most effective research operation is that which is organized around and oriented towards the creative minds it employs.

STEELE, Lowell W. "What's the Boss For?" IST, No. 43 (July, 1965), 52-57.

The attitudes of scientists and engineers toward the technical manager in a large industrial organization.


The search for scientific talent among high school students and the elements of this talent.


A survey of the individual factors influencing creative sciences and the inherent dangers in political and financial influences on organized research.

How criteria of scientific performance and creativity can be predicted from biographical information.


The findings of a study sponsored by the Office of Naval Research "to learn how to detect specific scientific talents and to understand the differences between scientists and non-scientists."

TRYTTEN, M. H. "Advisory Committee on Scientific Personnel," Science, C11 (April 12, 1946), 437-.

Committee's report recommending inservice training for federal science workers and revisions in civil service regulations.


Points out wide areas for research and reinvestigation.


Creativity in working methods and attitudes would improve the quality of research.


Gives 11 specific examples of technological innovation and suggests the need for more study of the same.


Studies research output of Nobel laureates and the effects of the award upon productivity and work.


A study of the American Nobel prize winners and their institutional affiliations.
SECTION 9

INTERNATIONAL SCIENTIFIC AND TECHNICAL COOPERATION

Possibilities of international scientific and technical cooperation exist at several levels. National scientific and technical organizations have often formalized and facilitated international communication by forming international unions with their counterparts in other countries. Such unions, and the International Council of Scientific Unions, are discussed in section 9.2.1. International scientific and technical unions often serve as the instruments through which international agreements can be made, e.g., the allocation of radio wavelengths for communication and the reservation of some frequencies for radio astronomy.

Cooperative programs such as the International Geophysical Year have enlisted the scientific capabilities of many nations to further scientific knowledge. International scientific programs may be organized and coordinated by a body which is itself international, such as UNESCO (9.2.2.).

Because of the magnitude and resource requirements of many scientific and technical activities, nations may combine to share the costs of specific projects. Section 9.3.1 deals with Western European experience in such cooperative programs. Utilization, development, and protection of such international resources as international rivers (9.3.6) and the oceans (9.3.7) is often facilitated by cooperative programs.

Section 9.3.2 deals with the role of international technical assistance in social and economic development. Additional related materials will be found in 5.10.

9.1 GENERAL


The role of the International Council of Scientific Unions and UNESCO in promoting scientific cooperation.


Financing science at the supra-national level is a stringent requirement for most of the countries of the world.

Recommendations of a UNESCO-sponsored study of the present state of science and plans for international action.


The pre-war decline of international science, the differences between war research and true research, and the steps needed to restore international cooperation now that atomic energy has made it imperative.


Man's increasing power to control the fundamental processes of nature makes an international program for research and its applications imperative.


International scientific collaboration is highly valuable economically, scientifically, and politically when based on real needs rather than on idealistic or political principles.


Outlines views expressed at a meeting of the Society for Visiting Scientists.


Report of a conference on the above topics held under the auspices of UNESCO.
International Scientific and Technical Cooperation


OECD has had both immediate and long-term approaches to water problems.

OECD Observer, No. 31 (December, 1967), 11-14.

The OECD Energy Committee encourages national systems to cooperate through mutual aid agreements designed to take advantage of technical advances and lower capital and operating costs.


An address delivered to the Pakistan Association for the Advancement of Science relating existing forms of cooperation and suggesting improvements.


Coherent science policy should insure that international research activities are necessary and compatible with national exigencies and objectives.


Describes international cooperation in research and in applying science and technology to human needs.


Various examples of international cooperation in astronomy in war and peace.


A Soviet scientist discusses projects for international cooperation.

The advancement of basic research and the application of science to production can be furthered by UNESCO and other forms of international cooperation.


An expert on the Middle East outlines the greater contributions to the Point Four program which the social scientist could make.


Science as a vehicle for international cooperation and its unifying factors.

9.2 INSTITUTIONS AND THEIR ACTIVITIES

9.2.1 INTERNATIONAL SCIENTIFIC UNIONS


Reports on the eighth Triennial General Assembly.


The ICSU (the International Council of Scientific Unions) established CODATA, the Committee on Data for Science and Technology.


A scientific union "to organize permanent cooperation between the chemical associations of the membership-countries, to coordinate their scientific and technical resources, and to contribute to the advance of chemistry in the whole range of its domain."

Describes pre-W.W. II activities of the Union, its 1947 assembly, and its arrangements for collaborating with UNESCO.


Organization and achievements of the Council from 1931 to the completion of the International Geophysical Year in 1958.


The structure and activities of the International Council of Scientific Unions.


Plans for the 14th General Assembly meeting of the Union.


The activities of the Union and a program for cooperating with UNESCO.


Political and language problems of the only scientific union with Soviet membership.

9.2.2 UNESCO


Functions of UNESCO in coordinating scientific efforts and disseminating information.

UNESCO efforts to stimulate and facilitate the participation of physical scientists in peaceful and constructive cooperation.


Scientific developments since 1945 with special reference to the role of the U.N. in encouraging communication and cooperation.


FLORKIN, Marcel. "Ten Years of Science at UNESCO," Impact, VII (September, 1956), 121-146.

Evolution of the program of the Department of Natural Sciences and the achievements of UNESCO in international scientific cooperation, teaching, and the dissemination of knowledge.


Scientific activities of UNESCO and the International Council of Scientific Unions.
Reviews some of the scientific accomplishments of UNESCO.


The activities of UNESCO in science: field science cooperation offices; aid to international scientific organizations; popularization of science; and special conferences.


The proposed program for 1963-64 with background information and graphs to illustrate the budget.

UNESCO assists international scientific organizations; improves scientific documentation and abstracting; operates Field Science Cooperation offices; encourages research; and disseminates science among the general public.

The organizations affiliated with the International Council of Scientific Unions and the possibilities of their collaboration with UNESCO.


The work of UNESCO in encouraging science through field science cooperation offices; conferences on special problems; financial aid to research centers; and publications and educational activity.


"Let's Use the Atom for the Good of Mankind," Courier, VII (No. 12, 1954), 5-9.

The events of 1954 that led to a UN decision to set up an International Atomic Energy Agency and a conference on the peaceful uses of atomic energy.


Author is Chief, Division of International Cooperation for Scientific Research, Department of Natural Sciences, UNESCO.

9.2.3 OTHER ORGANIZATIONS


The International laboratory for biological research.


Report of a meeting sponsored by the South-East Asia Science Co-operation Office.

OECD's concern with economic development has given its educational studies and projects a common perspective and encouraged the view that education is intimately related to the central problem of political, economic, and social development.


The first regional center for nuclear science serving Iran, Pakistan, and Turkey.


Issues at the meeting of the Board of Governors of the International Atomic Energy Agency which show the interlocking of science and politics.

NOBLE, R. J. "Food and the United Nations," Pub Ad Aus, VI, No. 2 (June, 1946), 77-82; 100-104.

Description of the groundwork for the Food and Agriculture Organization (FAO) laid at a conference in Quebec, 1945.

PHILLIPS, Ralph W. "Food and Agriculture Organization Completes 15 Years," Science, CXXXII (September 30, 1960), 871-881.

A detailed description of the work and responsibilities of the FAO.


Recent developments which may add to the life and utility of the International Atomic Energy Agency.

SACHER, G. "International Bureau of Nuclear Standards," BAS, I (May 1, 1946), 12.

Organization and duties of a proposed laboratory to function as the "International Bureau of Nuclear Standards."


The first year of the newly established International Center for Theoretical Physics is described by its director. (See also idem., "Interaction at Trieste," New ScI, XXVIII (December 2, 1965), 672-674, for another report on the International Center for Theoretical Physics.)

An account, shortly after its founding, of how the WHO came into being, its objectives, and how the machinery of an international organization works.


The structure and functions of the Organization which was founded under the auspices of UNESCO "for the better mobilization and utilization of scientific resources of research on the brain."

9.3 COOPERATIVE PROGRAMS

9.3.1 EUROPEAN AND NORTH ATLANTIC PROGRAMS


The program to build a 300 GeV proton synchrotron and other aspects of high-energy physics development in Europe.


The European Space Research Organization with special reference to its satellite program.


Various post W.W. II forms of cooperation and suggested desirable future developments.


The European Space Research Organization and the European Launcher Development Organization.


A recommendation by the European Organization for Nuclear Research that a new giant accelerator be built.


The proposal for a huge proton smasher to be built by the European Organization for Nuclear Research.


Plans for a European Space Research Organization. (For a report on the progress of the Organization five years later, see LOW, Ian, "Europe's Space Research Effort," ibid., XXXII (October 13, 1966), 41-42.)


Plans for a laboratory for the European Council for Nuclear Research.


Six European nations are collaborating in the European Space Vehicle Launcher Development Organization (ELDO) to produce a multistage rocket for launching spacecraft.


The prospects of commercial atomic power for the six Euratom countries:


A description of Euratom and the probable effects of Britain's membership.

The multi-nation organization for developing nuclear power.


Interview with E. C. WILLIAMS, director of SHAPE Air Defence Technical Center (SADIC) of NATO.


The history of and the working relationship between scientists and administrators in this multi-national basic research establishment, the European Organization for Nuclear Research (CERN). (For a later report see BAKKER, C. J., "CERN as an Institute for International Cooperation," ibid., XVI (February, 1960), 54-57.


The organization and program of ESRO.


The organization of the European Organization for Nuclear Research (CERN).


The establishment, membership, program and long range plans of the European Space Research Organization (ESRO).


The organization of ELDO and the contributions made by its member countries.


The European Conference of Ministers of Transport has begun a study of a general transport policy which may improve efficiency and reduce waste.
International Scientific and Technical Cooperation


Proposals for an international graduate institute in Europe.


The non-military science program carried out under the auspices of NATO.


Discusses the objectives and activities of the European Nuclear Energy Agency (ENEA), which was created in 1958.


The OECD's high temperature nuclear reactor project.


Goals, activities, and prospects of the company, which was constituted in 1959 as a cooperative project of twelve member countries. (See also idem., "Eurochemic: World's First Internationally Owned Nuclear Fuel-Reprocessing Plant," OECD Observer, No. 24, October, 1966, 24-25.)


The economic and technological factors which have increasingly encouraged cooperation in power production among European nations.


A member of Britain's House of Commons Select Committee on Science and Technology reviews the Committee's report on the nuclear power program and urges more European cooperation.

Survey of the extent of recent aid programs; an examination of some reasons for the failure of aid resources to expand; and suggestions for re-evaluation of aid policies.


The organization of the biological division; its work on radiation hazards; its use of radioisotopes; and its training program. (See also GUÉRON, J., "The Lessons to be Learned from Euratom," ibid., XXIII, March, 1967, 38-41, in which the objectives and progress of Euratom are discussed.)


Reasons for continuing the European Launcher Development Organization.


The growth of the role of science and technology in NATO.


Describes the European Organization for Nuclear Research.

WILDE, M. S. "Europe's Expanding Nuclear Research Centre," Courier, XIX (March, 1966), 5-8.

CERN, the European Organization for Nuclear Research, plans to build a 300 GEV accelerator which would be the largest in the world.


International collaboration on scientific and technical problems of Africa.
9.3.2 INTERNATIONAL TECHNICAL ASSISTANCE


Technological aid should be realistically designed to meet both the socio-logical and material needs of the individual nations.

BLACKETT, P.M.S. "New Science or Old Technology?" *BAS*, XVII (February, 1961), 53-54.

Since speed is essential in initiating the economic growth of underdeveloped countries, it is impossible to wait for new scientific and technological methods.


The need of underdeveloped countries for trained personnel and a system whereby British university staff could take temporary posts overseas.


Existing programs of technical assistance and the policy guidelines that have been established.


The composition and function of the Technical Assistance Board and examples of its projects.


Report on an international conference on applications of science to the needs of newly independent countries.


Report from the U.N. Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas.
Many technical assistance programs have suffered because of lack of recognition of two problem areas: incompatibility between the concept of international aid and that of national sovereignty; and incompatibility between the ideal of international assistance and the policy of neutralism.


Includes 17 articles on the administration of technical assistance.


The need to study techniques of transferring technology and the need for joint efforts of physical and social scientists to stimulate research and development.


Some of the technical assistance programs of the International Atomic Energy Agency.


Means of aiding the less-developed countries to improve their agriculture.


Some of the problems involved in technical aid, such as bridging the gaps between an advanced industrialized society and a traditional under-developed society.


Study of the utilization of foreign manpower in developing countries as providing high level skills and as training agents for necessary skills.
The purposes, organization, and examples of technical assistance of this U.N. program.

The need for and the problems of long-range planning.

Foreign aid in science and technology may stifle Indigenous science as well as conflict with national cultures.

Foreign aid and its effect upon both the giving and receiving countries.

Urges more technical assistance to developing countries, including help in developing research capacity suited to developmental needs.

Reviews government policy in regard to colonial development and discusses such projects as control of tsetse flies and other pests, development of fisheries, and mechanical aids to agricultural production.

Describes an international project sponsored by UNESCO.
Section 9


The program of the International Hydrological Decade to survey the earth's water resources and plan for their efficient use.


The program for the International Years of the Quiet Sun. (See also idem., "International Years of the Quiet Sun," Nature, CCIV, November 14, 1964, 621-625.)


The possibilities of space cooperation between the U.S. and the Soviet Union.


The organization for the International Geophysical Year.


The different fields of study proposed for the IGY.


Summarizes the program proposed for the international study of 1964-65.
International Scientific and Technical Cooperation


A plan for cooperative Soviet-American space exploration.


Summarizes the views of international scientists on a lunar laboratory and an orbiting laboratory in space.


The advantages of the proposed research program to be carried out in both the northern and southern hemispheres by one and the same group of astronomers from Cornell University and the University of Sydney.


The 1955 international conference on development of atomic energy for peaceful purposes will benefit the U.S. since we will engage in a "trade, not aid" of knowledge with Europe.


The purpose of the International Geophysical Year and some of its projects.


An article by the chairman of the U.S. National Committee for the IGY.


Describes a cooperative cosmic ray investigation in Antarctica with the U.S., Russia and Britain participating and joined later by France and Australia.

The results of the International Geophysical Year and proposed future forms of international cooperation.

... "The International Geophysical Year in Retrospect," Endeavour, XXII (May, 1963), 70-74.

Some of the accomplishments of the IGY in such fields as oceanography, Antarctic research, radiation belts, and solar patrol.


The background of technical assistance and steps to take in making such assistance really effective.


The International Hydrological Decade, a program of study of the world's water resources and their use, is complemented by the U.S. Water for Peace program.


Problems in creating an artificial satellite, its uses, and arrangements for international participation.


A report on the organizational set up followed by one of the Soviet papers presented at the Rocket and Satellite Symposium.


Progress in an international system of satellite communications awaits decisions on policy, international organization, and administration.
International Scientific and Technical Cooperation


Reports on some of the U.S. projects for the International Years of the Quiet Sun.

PUSHKOV, Nicolai and Boris SILKIN. "The Years of the Quiet Sun," Courier, XIX (September, 1966), 22-28.

The International geophysical activities of 1964-65 are discussed.


The history of the large national centers for nuclear research demonstrates the possibility and fruitfulness of international cooperation in the fundamental and applied sciences.


The use of radio in exploring and measuring techniques for investigating the earth and the universe, and the importance of developing international cooperation in this connection.


Research purposes and procedures of the International Year of the Quiet Sun.


9.3.4 BIOLOGICAL SCIENCE


The complete text of the proposal for the International Biological Programme.

Describes the International Biological Programme.


The work of the Pacific Science Board of the NAS-NRC and of the International Pacific Science Association.


The critical importance of microbiology to human welfare and the need for more research and cooperative programs such as the UNESCO Micro-organism Program and the International Biological Program.


Reviews a conference held in London.


The organization, guidelines, purposes, and possibilities for success of the program.


International cooperation is vital, particularly in ocean studies, photosynthesis and food production, brain research, public health, and medical science.


Surveys present and future international work in biology, including the proposed International Biological Program.

The facilities, health care of experimental animals, and research programs in somatic radiation effects and their modifications; the prevention and treatment of radiation disease; and the toxic effects of radioactive isotopes.


Plans for an International Biological Program to study such topics as human adaptability, conservation, production processes, and marine communities. (See also CALDER, Nigel, "World Biology Project Takes Shape," New Sci, XXIII, July 30, 1964, 260-262, which describes the further development of the program.)

9.3.5 HEALTH


Discusses a proposal for a world health research center and urges that a location in England be offered. (See CALDER, Nigel, "The Controversy about World Health Research," New Sci, XXV, January 28, 1965, 207-208, which presents arguments for and against such a center.)

DUNHAM, George C. "Inter-American Cooperation in Medicine," JAMA, CXXVIII (May 19, 1945), 170-173.

The activities of the Institute of Inter-American affairs.


The World Medical Association and its work.


Report of a U.S. delegate to the 15th World Health Assembly.

The work of the World Health Organization.


The complexity of world health organizations and the large role played by the U.S.


International cooperation in medicine and the encouragement of personnel exchange programs between hospitals in the U.S. and those abroad.

9.3.6 INTERNATIONAL RIVERS

HIRSCH, Abraham M. "Utilization of International Rivers in the Middle East," AJIL, L (January, 1956), 81-100.

"A study of conventional international law."


Describes successful international river development projects in Europe, North America, and Asia.


Briefly describes river development projects in different parts of the world.


Future river projects will involve several nations in integrated programs of technical and social development.
9.3.7 THE OCEANS


The International Indian Ocean Expedition—a cooperative effort of 20 nations—and its plans to explore every aspect of interest to oceanographers.


Attempts under the Food and Agricultural Organization of the UN "to consider the rational utilization of tuna resources in the Atlantic Ocean."


The program for oceanographic study of the Indian Ocean.


The need for world-wide cooperation in order to obtain elementary information about the oceans and coastal regions.


Politics, economics, science and the International Whaling Commission.


International cooperation in oceanography is necessary and two examples of this are the International Indian Ocean Expedition and the International Cooperative Investigation of the Tropical Atlantic.


The Intergovernmental Oceanographic Commission of UNESCO plans international studies of the Caribbean and Mediterranean regions.

Various UN bodies are concerned with study of the resources of the sea, and especially of fisheries.


History and activities of this European organization, founded in 1902.

9.3.8 POLAR REGIONS


The participation of citizens of various nations in the Antarctic and their motives—adventurous, economic, scientific, political and strategic.


Includes 14 articles in the following categories: Introduction; Canadian Arctic Biology; National Agency Programs and Support of Arctic Biology in the United States; Centers of Arctic Biological Research.


This introduction is followed by twelve articles on the U.S. Antarctic programs coordinated by the National Science Foundation.


An account of the research programs operating in Antarctica, particularly the American ones and their relationship to international efforts there.


Antarctica, as a laboratory and as an arena for international scientific cooperation, has been stimulated by the International Geophysical Year and by the International Years of the Quiet Sun.
International Scientific and Technical Cooperation


Reviews the ten-year period of international scientific cooperation in the Antarctic.


International cooperation in Antarctic research has culminated in the Antarctic Treaty which ensures that the polar continent will be reserved for peaceful purposes only.

ROBIN, G. de Q. "Future Antarctic Research," New ScI, V (March 5, 1959), 504-505.

The Special Committee on Antarctic Research is an International group set up to review the aims of research in the Antarctic.


International activities in Antarctic during the International Geophysical Year.
SECTION 10

ORGANIZATION AND MANAGEMENT OF RESEARCH AND DEVELOPMENT

Items in this section are concerned with the structure, economics, management, and implications of large scale scientific and technological research. Section 10.1 covers general discussions of private and government-financed research and development.

Section 10.2 is oriented particularly to research and development programs in U.S. Government administrative agencies and research institutions. Some of the articles describe particular programs or institutions. Related items will also be found in Section 5.2.1.4. Other articles cited deal more generally with the place and characteristics of research and development in government.

Section 10.3 refers to industrial research. Among the questions suggested by articles cited here are: How necessary to future growth is a strong industrial research and development program? What is the place of basic research in industry? What are the relationships of Industrial research to academic and governmental research?

Section 10.4 deals with research and development in universities. Many of the articles discuss the increasingly complex and interdependent relationships between academic research and governmental missions and programs in the United States. The development of contract research in universities, managerial problems of such research programs, and the impact of contract research on traditional academic goals and values receive particular attention in the literature cited. Additional items will be found under the national or group headings of Section 5. Some of the implications of academic research and development for the education of scientific and technical personnel are discussed in Section 6.2.

Section 10.5 refers to not-for-profit research institutions such as the Rand Corporation. Section 10.6 is concerned with problems of resource allocations for R & D. Such problems are important in industrial as well as in governmental decision-making. Among the topics discussed are the degree of mission specificity which can be imposed on an R & D program; accounting procedures for evaluating optimum returns from support; and—Importantly—the side-effects of alternative levels and kinds of support on the development of science, on academic institutions, and on the processes of management or government.
Section 10.7 deals with problems of the administration of R & D programs, including the functions of the administrator and his relations with scientists. Additional items relevant to personnel administration will be found in Sections 8.3 and 8.5. The trend in recent years, particularly in industry, has been towards increasing management of R & D activities and the setting of R & D objectives as an integral part of overall policy and planning.

10.1 GENERAL


Attempts to identify the direction in which science is going and the forces that are shaping its future.


The distinguishing features of multidisciplinary team research, some of the problems encountered, and ways of minimizing them.


Gives examples from the history of drug research which show that the best results have been obtained by close collaboration between academic and industrial laboratories.


The impact of R & D on science and technology and the effects, both good and bad, on industry, the universities, and research organizations.


The importance of an adequate program of basic research for future technological developments in defense.

Summarizes an address by O. W. HUMPHREYS in which he discusses the advantages of collaboration by research organizations.

HEIMAN, F. P. "Evaluation of Research from the Viewpoint of the Practicing Scientist," Res Man, VIII (May, 1965), 139-144.

Discussion of corporate policies to ensure top quality research.


Analysis of factors which should be examined before the decision is made to develop a new research complex.


The organization and conduct of science which can apply to other fields of scholarship and a qualitative model of the growth process of scientific research.


Papers and discussion include: Freedom on Organization in Scientific Research by Pierre AUGER; Lessons the History of Science Teaches by B. KEDROV; Bottle-necks and Interactions between Disciplines by P. PIGANIOL; The Organization of Scientific Work among the Sciences and Its Relations to Technology and Culture, by Gerald HOLTON and Research in the Human Sciences by M. DEBEAUVAS.


Technological development has requisites for success different from those for pure research, including time-saving techniques in planning and execution and different financing.
KIDD, Charles V. "Basic Research - Description Versus Definition," Science, CXXIX (February 13, 1959), 368-371.

Basic research "has not yet been defined and may never be defined so as to permit an unambiguous, objective measurement of the dollars spent for basic research in this country."


The dilemma of research in reconciling the intellectual freedom required for effective exploration of the unknown with the selection and direction of effort implicit in the functions of any organization.

MARSHAK, Robert E. "Basic Research in the University and Industrial Laboratory," Science, CLIV (December 23, 1966), 1521-1524.

The contrasting roles of university and industrial research directors in basic research enterprise.


The principal features of operations research and how they can be applied to large and complex organizations to increase efficiency.


Remarks on the organization of scientific research, using the analogy of research as a chain reaction. (Reprint from the book by the same name, Wiley, 1966), pp. 53-70.)


The scientific and political aspects of defense planning and the need to keep up the momentum of research.


The problems arising from the assumption that operational definitions of "basic research" and "applied research" exist.

The characteristics of the traditional entrepreneur--especially risk-taking--should mark the engineer and the technical manager.


Urges increased investment in R & D and predicts a radical change in certain aspects of federal administration of science as growth rate declines.


Argues for the systematic development of new technologies based on new principles in bridging the gap between research and development.


A spokesman for industrial research and a defender of the nonprofit research institute discuss the activities, tax statuses, and responsibilities of the two kinds of operations.

10.2 RESEARCH IN GOVERNMENT INSTITUTIONS


The close association of national laboratories with universities and the needs they fill in providing expensive research apparatus and climate for group research.


(For the nature and scope of work of the Bureau in 1951, see CONDON, Edward U., "Present Program of the National Bureau of Standards," ibid., LXXIII, September, 1951, 176-182.)

The Smithsonian Institution's encouragement of international interest in preserving the productivity of tropical environments.


A brief history of the Coast and Geodetic Survey which charts coastal waters and establishes geodetic control in the interior of the U.S.


An address given upon Condon's resignation as director of the National Bureau of Standards. Encourages greater government support for non-military science.


Gives the laboratory's history, organization, and plans for the future.


Since research laboratories under private management have been most brilliantly productive, the laboratories under military or civil service control should be transferred to private management contracts.


An account of the early history and development of the National Radio Astronomy Observatory at Green Bank, West Virginia.


Work of the National Center of Air Pollution Control in supporting research.


The new Environmental Science Services Administration of the Commerce Department.
FLEMMING, Arthur S. "Scientists and the Civil Service," Sci Mon, LXIV (June, 1947), 515-520.

The U.S. Civil Service organization for recruitment of scientific personnel, the development of job classification standards, and steps to be taken to attract and hold well-qualified scientists.


Evaluation of progress made in the U.S. Fish and Wildlife Service from 1935 to 1946.


The basic research program of the ONR between the end of W.W. II and the formation of the National Science Foundation.


The employment of scientists by the U.S. government and the need for competent administration and adequate technical information.


Remarks about the development of research within government bodies and in the broader area of government-sponsored research.


Describes the Detrick research program, University of Pennsylvania, and the involvement of the Public Health Service and various universities and research institutes. (See also idem., "Chemical and Biological Warfare (II): The Weapons and the Policies," Science, CLV, January 13, 1967, 299-333, for a discussion of the chemical arsenal, research on incriminating chemicals, biological possibilities, and U.S. policies.)

The work of the National Bureau of Standards and its new quarters at Gaithersburg, Maryland.


The increased number of scientists employed by the federal government and the impact this has had on federal personnel policies.


Background of the Navy's important work in basic science after W.W. II.


The early work of the ONR gave great support to basic research before the National Science Foundation was established. (See also Luther J. CARTER, "Office of Naval Research: 20 Years Bring Changes," Science, CLXIII, July 22, 1966, 397-400, for a discussion of present personnel, research trends, and budgetary problems.)


Description and documents relating to the forced resignation of the director of the National Bureau of Standards, allegedly because of controversy over the worth of a certain battery additive. (HARNWELL, Gaylord P., in "Integrity of Science in Government," ibid., VI, June, 1953, 4, comments on Astin's resignation; ASTIN, Allen V., "The National Bureau of Standards," ibid., VI, June, 1953, 12-13, describes the work and importance of the National Bureau of Standards; "The Kelly Committee . . . A Summary," ibid., VI, December, 1953, 4-11, summarizes the functions and operations of the National Bureau of Standards.)


The program of the Office of Naval Research to encourage basic research after W.W. II.

Support of basic science by the Office of Naval Research, the dangers of uniformity and centralization of government support, and the responsibilities of scientists to work in areas other than pure research.


Advocates the creation of national research and development centers in order to fulfill the need for large scale facilities and to explore and develop new devices for basic biological research.


The pursuit of broad objectives at the Institution in biological research in systematic biology, photobiology, physical anthropology, conservation, education, and environmental biology.


SHALOWITZ, Aaron L. "Nautical Charting (1807-1957)," Sci Mon, LXXXIV (June, 1957), 290-301.

Reasons for coastal charting and the evolution of the Coast Survey in the 150 years since it was incorporated into U.S. law.


The basic problem of centralized responsibility vs. decentralized management is common to both military and non-military R & D.

SHELESNYAK, M. C. "Arctic Research Laboratory, Office of Naval Research, Point Barrow, Alaska," Science, CVII (March 19, 1948), 283.

The origins, purposes, and scope of the laboratory.


The need and difficulties in getting capable people for government work as managers of huge research, development, test, and engineering programs. (See also comments by Helmut WAKEHAM, ibid., pp. 105-106.)


Capsule history from the Museum's origins in U.S. expeditions, 1838-1842, to a national museum.


How space age demands are outpacing the existing standards of the exactness of measurements in the National Bureau of Standards.

10.3 INDUSTRIAL RESEARCH


Criteria and quantitative methods are suggested for dealing with such questions as the funding of research projects, how long development should take, and the termination of unsuccessful research.

BARNES, Carl E. "To Promote Invention," IST, LX (December, 1966), 67-73.

The lack of creativity in industrial research and how farsighted management and revised patent laws might encourage productivity.


Analysis of the importance of basic research in industry in terms of dollars and cents.

The probable impact on industrial research of a general profit squeeze and an increasing amount of government-supported research.


Case history of the development of NCR (No Carbon Required) Paper.


The basic factors governing industrial research in the U.S., Britain, Germany, and other countries.


Predicts continued growth of investment in R & D, but at a smaller rate and with more management integration with corporate policy.


The extent of basic industrial research can be measured by the publication of results.


Science needs the resources which business can provide, and in order to provide them, business depends on the products of scientific advance.


Scientific manpower, fundamental scientific knowledge, capital, and their relationship to industrial research are discussed.


The three broad effects increasing government expenditures have had from the standpoint of industrial management.

The programs and methods of industrial research and their effect upon academic research.


The problems of a company which integrates government-sponsored R&D programs with its own programs.


Lessons to be learned from the experience of pioneers and leaders in design.


A study of the problem of materials which urges advance planning for research because the speed at which man augments his resources in the next fifty years will be crucial for social welfare in the 21st century.


Industrial research reduces the time interval between the fundamental principles of an invention and the appearance of a usable product.


Asks how much freedom is compatible with the aims of industrial research; what criteria should be used in determining the degree of freedom given an industrial researcher; and how the principle of free inquiry can be incorporated into the administration of industrial research.


A vice-president of Westinghouse Electric Corporation discusses the place of and requirements for basic research in industry.

Gives reasons why small firms should engage in R&D and summarizes some major steps in beginning a R&D program.


The enthusiasm with which industry has adopted the research technique created a competitive situation and increasing efficiency in research operations is required.


Chemical development is being stimulated by competition but is not likely to benefit from an overdose of government in research.


Describes five ways in which a small businessman can make use of R&D facilities outside his own company.


Types of inter-firm cooperation in the U.S. petroleum, pharmaceutical, and aerospace industries.


Strains and accommodations between science and industry in the formulation of goals for research, modes of control over research, different systems of incentives, and responsibility for the utilization of research.


Brief summary of techniques found useful in industrial research.

The advantages of American companies basing their research operations on government contracts are counterbalanced by the disadvantages.


"A detailed analysis of the approach and organization developed by the components research and engineering head of the Bell Telephone Laboratories responsible for the applied research and development programs on the transistor."


Account of the creation and goals of the European Industrial Research Management Association (EIRMA).


Some factors noted are the impact of government on industrial research, corporate planning, execution of plans, and foreign laboratories.


The analyst has to have an appreciation of technological developments. Author is Vice-President, Keystone Custodian Funds.


Maximum financial returns for industry from R&D in this area are contingent upon coordination of development with overall company policy.


The reasons for setting up an overseas technical operation by an American company and the problems involved.

The role of an overt industrial intelligence activity concerned with technical, social, economic, political, or scientific events which may influence the availability, value, or need of technology.


Basic research in industry in relation to broad scientific inquiry; its main features and its possible future contributions.


An examination of the hectic competition for scientific and technical personnel in industry.


Requirements for an industry's success in this area.


Considers the relationships and interdependence between science and engineering "in the research and engineering phases of a highly technical industry."

WOODWARD, F. N. "Industrial Research: How Should It Be Carried Out?" OECD Observer, No. 12 (September, 1964), 40-42.

Report of an OECD study on research associations and cooperative research organizations.

10.4 RESEARCH IN UNIVERSITIES


Comments on hearings before a subcommittee of the House Committee on Government Operations concerned with research and technical problems, especially those applying to the universities.

The association of the National Aeronautics and Space Agency with the nation's universities.


Aside from the main goals of training students and adding to knowledge, university research should not otherwise differ from industrial research.


The importance of basic research in providing intellectual capital for society, the various methods of research organization and the need for a balanced progress, and sources of support.


Methods of utilizing federal support of research and education while avoiding the dangers of federal control.


Discussion of whether or not a university is the place for secret contracts, using the University of Pennsylvania as an example.


Introductory article to a special issue on university research. Examines its expenditures, problems, and trends. Remaining articles examine the organization and research activities of 8 different universities. (See also same author, "Trends in University Research," ibid., VI, No. 4, April, 1964, 30-37, which concludes that the new trends are favorable to education and the nation, and WHEADON, William C., "Organizing University Research," ibid., VI, No. 4, April, 1964, 38-47, which suggests a solution for sponsored research which would not smother institutional goals.)
Advantages and dangers of sponsored project research for universities.

The importance of research to the academic institution; rising equipment costs; the need for more team effort; and the importance of adequate support and freedom for the men working at the institution.

GARDNER, John W. "The Government, the Universities, and Biomedical Research," Science, CLIII (September 30, 1966), 1601-1603.
The successful partnership of the last 30 years, particularly as exemplified by the National Institutes of Health.

The positions of the faculty and the administration, and the emergence of the question of power relations within the University as a fundamental issue.

The close relationship between research and university teaching and the need for contact among universities, government, and industry.

Suggests stopping all governmental payments for overhead in basic research in private universities.

The growth of research support by the federal government and the impact upon the universities.

Federal grants are needed for scientific research in universities, but unlimited funds do not assure quality or maximum returns.

The scientific research facilities available in colleges and universities and the conclusion that an expansion would benefit the institutions and the nation.


The university must serve as an unimpeded source of ideas for the future needs of industry, government, and the nation.

PITZER, Kenneth S. "Race of the University in Basic Research," Science, CXXI (June 13, 1955), 789-792.

Describes the university as the ideal atmosphere for unimpeded basic research, finances being the key for its effective maintenance and improvement.


The administration of university research must first protect the university's goals, but not to the point of frustrating scientific creativity.


Some historic failures which suggest that major political issues may still be involved in the support of science.

ROSSI, Peter H. "Researchers, Scholars and Policy Makers: The Politics of Large Scale Research," Daedalus, XCIII (Fall, 1964), 1142-1161.

Deals with the organization of research in the university environment.


Some of the administrative problems in federally-sponsored university research and attempts to simplify administrative regulations.

The science taught in universities must at every stage emphasize creative scholarship—a view of science and the scientist as untrammeled by the narrower views which must of necessity be imposed in industry.


Criticism of the universities' passive agreement to federal controls and of the government's dictatorial approach to academic research.

STRICKLAND, Stephen and Theodore VALLANCE. "Classified Research: To Be or Not To Be Involved?" Ed Rec, XLVIII (Summer, 1967), 224-235.

Issues involved in classified research, standards for evaluating it, and practical tests for gauging the relevance of "classification."


Findings of the House Select Committee on Government Research and other Congressional committees concerned with R & D.


The need to keep universities free and unobligated in the face of government research needs which are mainly military.


Editorial comment on regional over-concentration of working scientists and engineers and of industrial and defense strengths.


An examination of federal grants to, and federal grants with, universities for research, made by a research administration at Princeton.

Remarks on the development of contract research in universities, its direction, and its impact on the educational system.


A government-sponsored program carried on at selected universities.

10.5 RESEARCH AND DEVELOPMENT ORGANIZATIONS


The Research Institute for Advanced Studies (RIAS), employs 50 scientists to engage in research with no immediate payoff on the grounds that today's basic research is tomorrow's technology.


Remarks by the president of the Carnegie Institution of Washington on the role of the research institution in fundamental research.


A new branch of the Battelle Institute and its activities in sponsored research for industry.


The role played by independent research organizations to complement more specialized industrial research laboratories.


The roles and influence of the 47 specialized laboratories which currently spend an aggregate budget of $1.2 billion.

The role of the tax-exempt institutions, which perform research for government and industry, in the nation's overall R & D performance.


Describes this "non-profit foundation which distributes its total net income as grants-in-aid of research to colleges, universities, and scientific institutions."


Independent research foundations in the U.S. and their usefulness to industry and to universities in carrying on sponsored research.


The purposes of "group" research are to produce new products and processes and to reduce production costs for the industrial sponsors.


The history of the Research Corporation, its present distribution of funds, and the current role of private support for research in view of the great expenditures required, especially in physics.


America's non-profit corporations and institutions as government advisors.
The origins and purposes of the RAND Corporation. (See also ibid., "RAND: After Nearly Two Decades of Success, R & D Nonprofit Faces New Tasks, New Rivals," Science, CXLIV, June 5, 1964, 1205-1207, in which the increased degree of political and economic analysis in RAND's research and other changes in its orientation are noted.)


A new Institute for basic research established by American funds in Britain which was intended to draw staff from continental countries as well.

10.6 ALLOCATION OF RESEARCH SUPPORT


The interaction of scientific research with governments and universities as related with the exponential growth of science itself.


The adequacy of government sponsorship since Sputnik and suggested alternative measures to correct deficiencies.


The difficulties of allocating resources in science.


Reducing government expenditure on research and development would lead to more activity by private firms with greater results.


A list of "warning flags" possibly useful in terminating a project which seems to be getting nowhere.

Urges more relevance of government R & D expenditures to healthy economic growth.


There is no general formula to tell a company how much to invest; determinations must always be made for the particular case.


The role of investment groups specializing in financing new science-based ventures or rescuing those in difficulties in return for equity.


Federal expenditure on research and development in the U.S. is concentrated in defense and space activities which contribute little to the nation's economic growth or to the relief of unemployment.


To cope with the rising costs of research and development, the Defense Department is shifting from fixed fee contracts to incentive contracts that encourage efficiency.


Trends in U.S. research spending and some typical costs of operating R & D laboratories.


A statement before a Congressional subcommittee by the retiring president of the AAAS.

The effectiveness of R & D contributions to the civilian economy and the respective roles of government and industry research activities.


Summary of seminars discussing various effective techniques for selecting and evaluating R & D projects.


Proposals for basic research merit greater consideration from the government than they have had up to now.

HOLMAN, Mary A. "Patents for Rand D," BAS, XX (October, 1964), 32-34.

Few of the thousands of patented inventions arising from government-sponsored research hold any commercial potential.


The level of federal support needed to maintain for the U.S. a position of leadership through basic research in the advancement of science and technology and their applications.


Industry should support basic research, not only in its own laboratories, but also at universities and other institutions.


Proposes tax incentives to encourage people of all income tax brackets to contribute to financing basic science research in order to relieve the burden on the U.S. treasury.

The freedom needed by outstanding individual scientists is not encouraged by the project method of support.


Criteria for making decisions about the direction of scientific effort.


Summary of report made May, 1962, by U.S. Bureau of the Budget describing the growth of federal involvement in R & D since W.W. II.


Industry and laymen now appreciate the value of and will support applied research, but pure research, supported primarily by the government, is likely to be biased in the direction of such pragmatic ends as national defense.


Research has been "oversold" with the result that it is sometimes an undetected leech on profit and progress.


Models and matrix definitions of R & D activities by means of which accounting procedures may be developed.


Using social benefits as the rationale, the authors sets up four categories for priority of government research funds.

Discusses procedure followed in the Esso Research and Engineering Company in preparing the annual research budget.


The private foundations have a unique opportunity to support the most progressive experiments and respond more quickly to new needs.


R & D activities suitable to accountants and financial analysts and the need for detailed financial records of research projects.


Discusses basic research as a productive investment and as a pleasurable consumption activity.


Influences of the Budget Bureau on research and development budgeting.


Analysis of research and development appropriations for fiscal 1968, with breakdowns and comments for department and agency budgets.


Federal, Industrial, and private support and new trends in the organization of biological research.


The author is a Research Associate for the RAND Corporation.

Suggests that more support be given to individuals with complete freedom of research rather than to organized projects.


Survey data shows percentage of research investment in American industry, industry attitudes towards research, and the profits from research.


An evaluation of the interrelationship of increasing members of qualified scientists and technologists, national economy, productivity, and the proper expenditure on research and development.


Reviews four previous articles in Minerva on the subject of scientific choice and derives some practical considerations for administration of science with special reference to Britain. (See also Idem., "The Complexity of Scientific Choice: Culture, Overheads or Tertiary Industry?", Minerva, IV, Winter, 1966, 155-169, for further discussion relating to government support of science and the place of science in an industrialized society.)


The implications of government subsidy for basic research and the importance of maintaining the freedom of our universities.


Asks: What is the role of science in achieving national goals?; On what basis is its federal support justified?


U.S. expenditure on basic research, applied research and development, and the necessity for a balanced allocation of funds.

After considering the economic and political ties between government and basic and industrial research, authors conclude that national research is basic to national security.


Introduction to a series of articles. Raises the question whether support of basic science in the U.S. is adequate and discusses the nature of basic science.


Although private foundations have available only one percent of government funding for basic research, these small foundation funds play a catalytic role in adventurous and exciting research areas.


Suggests that the criteria of technological merit, scientific merit, and social merit be used to determine the distribution of resources to science. (See also Idem., "Criteria for Scientific Choice II: The Two Cultures," Minerva, III, Autumn, 1964, 3-14, in which three criteria for determining society's support of science relative to other activities are given; his article with the same title in Phys Today, XVII, March, 1964, 42-48.)


Deals with the problems of assigning priorities in the support of basic and applied research.


The impact of research on economic development, the problems of arriving at an "optimum" R & D expenditure, and R & D as a function of gross national product.


Economic and social criteria must be applied to making the appropriate selections at each progressive stage of applied research.
10.7 MANAGEMENT OF RESEARCH ORGANIZATIONS


What an administrator should know about science and how he should acquire the information and skills he needs.


The usual ways of considering control of R & D work are too simple because its unpredictability makes it too complex for this model.


An industrialist discusses the function of scientists in industry and government.


Ideas shown to have practical relevance to R & D laboratories and to the management of R & D programs, as in the Department of Defense.


The unpredictable aspects of R & D have been so oversold to management that many companies lack realistic controls on budgets and programming.


Describes the increasing government expenditure on science and administrative and budgetary needs.


The results of study groups organized by the Industrial Research Institute and the responsibilities of the research supervisor.

John HUTCHESON, engineering vice president for Westinghouse, discusses the various factors involved in deciding on projects for a research laboratory.


Organizational concepts relevant to R & D enterprises, with cautionary remarks about applying program management at too general a level.


Requirements for effective applied research, the roles of government and industry, the best ways of formulating and administering programs, and attendant problems of communication.


The author is Manager of Research Administration, Union Carbide Corporation.


Several aspects of research administration as presented at a conference on Academic and Industrial Basic Research called by the National Science Foundation.


Summary of proceedings of first European Regional Seminar, sponsored by the OECD Committee for Applied Research.


Responsibilities of managers most immediately in contact with R & D activities.


The desirable qualities of a good research administrator and the pitfalls in the Western system of hiring as research administrators scientists lacking specific education in administration.
Since the direct administration of scientific research will be based on the answer of the authorities at that moment, a "wrong" answer may render science policy less effective.

Research administration should be geared to increasing the productivity of the research personnel.

Remarks on the strategic role of scientific administrators and their qualifications.

Managerial approaches to the problems raised by making administrators out of scientists, to the detriment of their scientific careers.

Investigates the compatibility of military organizations and scientific research.

The basic tenet is that all applied science should be regarded as a continuous spectrum of disciplines that can be administered by a single management.

Procedure used in an aerospace industry to integrate research planning and control into the overall division planning and control mechanism.

Role of research manager operating between scientists who want to do science and management which wants a "research payoff."

Problems of selecting administrative and communications aspects of research areas, the amount of investment, and requirement of lead time.


The trend is to increasing management of R & D activities, beginning with objectives as an integral part of corporate policy.
Science and technology are aspects of human culture and pervasive influences within and upon cultures. In the highly technoscientific cultures in particular, scientific concepts and views of man and nature have had important and demonstrable influences in such areas as literature, the arts, ethics, and religion. The effects of these influences are multi-dimensional. The history of science policy, whether in government or in industry, furnishes examples of conscious attempts to direct the work of scientists and technologists toward goals which are not themselves "scientific" or "technological."

Examples may also be found of non-directive extrascientific influences upon the development and methodology of the sciences. One recent example has been the concern felt by biologists as well as the general public over medical and physiological experiments on human subjects. Here humanistic and ethical restraints have operated to set certain boundaries on what is "permissible" in biological experimentation. Related materials will be found in Sections 2.3, 6, and 12.2.

Many of the items in this section demonstrate influences of science and technology upon esthetic, ethical, and religious perceptions of man and nature. The inclusion of such articles in a bibliography primarily directed to science policy may be justified on the grounds that it directs the attention to a broad perspective of the "fit" of science and technology to the needs and norms of society.

11.1 SCIENCE AND THE HUMANITIES

11.1.1 HUMANISM


Substance of an address suggesting inclusion of some humanistic studies in higher technological education.


The essence of technological humanism is the habit of apprehending a technology in its completeness.

Essentially, both science and the humanities seek to achieve knowledge and truth.


Contrasts those values of science and humanism which make for inevitable tension between them, and insists that a pattern of accommodation must be found so that each is able to fulfill its functions in society.


The influence of science on humanistic studies, the differences between them, and the fruitfulness of these differences in outlook, methods, and objectives.


Portrays the sciences as intellectual activities based on observation of the behavior of nature, the humanities as intellectual activities based on the observations of men in search of themselves, and the two supplementing each other.


Artists and scientists use common intellectual tools of analysis, synthesis, and reduction, and, if they are able to see each other's tools in action, they can understand each other at this level.


Some of the first steps taken to provide automated bibliographic services to scholars in the humanities and the social sciences.

The relationship between biology and the humanities as the study of man's responses to environment.


The limitations of science and the importance of humanistic studies.


Briefly views and classifies different theories on the relationship between science and values.


The scientist and the humanist have such traits as inquisitiveness, judgment, and imagination in common.


The study of man's position in the world of nature can help bridge the gap between a scientific and a humanitarian outlook.


Examines the claims of the humanities to provide a unifying focus for higher education.


War, aggression, and the arms race are destructive to the interests of humanity and prove that scientific and technical progress do not automatically bring about progress for humanity.


While social action should be guided by the scientific method, science itself should be guided by human values.

Science is man's most powerful tool in the use of his unique ability to direct and control his own evolution.


Education in the perspective of evolution, seeking to bring it to terms with humanism over its curriculum, its relations with society, and its methods of fostering the development of personality.


Analogies between scientific and religious faith, and the relevance of the analogy to the split of intellectuals into humanists and scientists.


The social sciences as the "middle science" between humanism and science.


The role of science and technology in ancient civilizations, their contribution to Britain's greatness, and the current need to integrate them with humanistic studies and thought.


Man can use science and technology in the interest of human welfare and the human spirit rather than to destroy himself.


Modern science and its relationship to man's spiritual and cultural concerns.


Scientists must seek concepts that "unite not only the sciences with one another, but also the sciences with the arts and humanities."

The dichotomy between man and the machine must be overcome if we are to be able to live in an industrialized world.


The doctrine that science is unconcerned with values is socially dangerous because the exercise of choice within academic freedom implies social values.


To achieve value and not be actively harmful, scientific and technological progress must be directed and modified by a social and humanitarian outlook.


In order to use technology for the long-term benefit of man and preserve the democratic process, we need professionalization of the decision-making process and basic education for all citizens. (See also idem., "A Humanistic Technology," Nature, CCVIII, November 20, 1965, 721-726.)


Suggests that humanistic ideals be given precedence over biological progress, which is only one facet of human activity.


Abridgement of the address given by the recipient of the Kalinga Prize for popularization of science.


A culture of new dimensions is emerging from the interaction of the arts and humanities with science, and the contribution of science to archeology and a computerized concordance with the works of St. Thomas AQUINAS.

Study of a 19th Century dialogue concerning tensions between "science" and "the humanities."


Qualities held in common by the sciences and the humanities should be emphasized in a liberal education.


The study of physical science is not compatible with humanistic studies except for those that have immediate relevance to scientific training.


A call for the study of variability and individuality in human beings for the purpose of helping to solve social problems.


The social effects of the scientific revolution and the need for training humanists in science to better equip them for handling social problems.

11.1.2 LITERATURE


Poetry and science satisfy the creative and curious elements of man's nature in much the same way.


Science and literature are both seen as acts of imagination limited by the ambiguities of language and operating within the field of self-reference.

Surveys science as a social force and the personality of the scientist as portrayed in the literature of this century.


Shows how modern mind has been influenced by the growth of science despite some antagonism from the literary world.

GREENE, D. J. "Smart, Berkeley, the Scientists and Poets," JHI, XIV (June, 1953), 327-352.

A study of the mid-18th century poet Christopher Smart's reaction to Newtonian science.


The difficulties of public acceptance of science and a sympathetic perspective of the scientists' problems in this area.


The contradictory models of the world made by poets and scientists, the methods they employ, and the views that result.


A study of a literary defense of science which linked science securely to the humanities, and accounts for its acceptance in 18th century France.


The "two voices" are a kind of antiphonal chorus—for and against science and all that it implies.


Science and poetry are two complementary interests of the human spirit which represent different facets of a unitary truth.
PIZER, Donald. "Evolutionary Ideas in Late Nineteenth-Century English and American Literary Criticism," JAAC, XIX (Spring, 1961), 305-310.

A study of the possible stimulation provided to the French literary imagination by the new astronomy of Copernicus, Kepler, and Galileo.

The effect of technology on communication of literature and on its subject matter.

Science and poetry as "partly overlapping spheres in which there is a common domain which ever changes under the changing tension."


Nineteenth-century poets were among the first to face the moral issue now raised by the atom bomb and the materialistic basis of society.

11.1.3 THE ARTS AND ARCHITECTURE


Aspects of the scientific literature which relate to the subject of how color affects people aesthetically. Footnotes. Bibliography.

The juncture "occurs fundamentally in the life of a human being."


The need for aesthetic considerations in the products of technology and discusses the training and role of the industrial designer.

CANTOR, S. M. "In Art: A Lesson for Chemistry," CEN, XXXIV (November 5, 1956), 5406-5410.

"Chemical education should include courses in art, not to teach the chemist how to paint, but to help him discover more dynamic meanings in his symbols."

CROCKER, Richard L. "Pythagorean Mathematics and Music (Part I)," JAAC, XXII (Winter, 1963), 189-198; Part II, XXII (Spring, 1964), 325-335.

An early attempt to use mathematics to clarify the nature of art.


Points out the unifying principle between science and art and the need to apply it in education.

ELSEN, Albert E. "Lively Art from a Dying Profession--The Artist of the Modern Artist," JAAC, XVIII (June, 1960), 446-455.


The customary division of the arts on the basis of space and time should be dropped in favor of adopting the "four-dimensional world of space-time," and viewing all the arts as dynamic.


Argues for a better understanding of the role of aesthetic values and their relationships with present-day technical values.

The sciences are much more akin to the creative arts than to the pursuits of humanistic scholars.


The three problem areas of modern art which are of interest to the psychologist.


The historical relationship between music and mathematics.


A "relatively scientific approach to design or painting" stating that the artist-designer must have some knowledge of contemporary science and philosophy.


KESSLER, Charles S. "Science and Mysticism in Paul Klee's 'Around the Fish'," JAAC, XVI (September, 1957), 76-83.

Modern theoretical science had a very significant influence on Klee's thinking and imagery.


Machines have their place in art museums only if the engineered object has undergone an "artistic remaking."


Attempts to explain the new concepts in painting by correlating them with the theories of contemporary physics.


Parallels between the shaping of musical experience and many details of information theory.

Possibilities for the development of scientific method in art and aesthetics, and arguments against fears about the "mechanization" of art if scientific knowledge and methods are used.


The behavioral sciences are providing insights into both traditional problems of philosophical aesthetics and pragmatic concerns with the role of beauty in social life.


The physics of music is used in bettering musical instruments, improving building acoustics, and increasing the quality of music reproduction.


The impact of modern science upon the visual arts.


The applicability of the quantitative experimental method to aesthetic research.


The relationship between art and mathematics.


The role of the performer in the context of his possible replacement by machine.

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Describes "the quest for symmetry, balance, and proportional relationships" in the history of art and shows that it exists even in today's technology.


11.2 SCIENCE AND ETHICS


The dilemma of identifying the ethics of scholarship as something distinct from the ethics of nationalism.


The discoveries of science are leading to new moral and religious problems such as population control, euthanasia, and abortion.


For early Victorians, natural science provided the norm by which proposed truths were judged; the alliance between religion and science was shattered by Darwin's evolutionary theory.


A refutation of the concept that normative ethics can be based on science.

Lists ten ethical problems associated with science and suggests a study of operating systems of ethical self-regulation. (See also idem., "Ethical Problems of Scientists," Ed Rec, XLVI, Summer, 1965, 282-295.)


The distinction between science and ethics; attitudes toward social law; and prevalent conceptions of the dichotomy between science and social law.


Ethics is not a science because it is not based on the certainties of experience and reason.


Possibilities and limitations of applying the "answers" of science to human problems; the ethics of scientific investigation; and ethical responsibilities of scientists.


Substance of a sermon delivered before the British Association on moral problems involved in the application of science to human life.


Determinism and Indeterminism; applicability of the concepts of human behavior; and consequences for ethics and morality.


Legislative action concerning treatment of laboratory animals raises a question as to the role other organisms should occupy in man's ethical system.

The autonomy of science must move from ethical neutrality to ethical competence and a sense of responsibility for transition.


All citizens are responsible for the right use of the results of scientific research. The scientific spirit and religion or morality need not conflict.


A humanistic approach involving 'genetic memory,' adaptive behavior, the physiology of behavior, and the roots of ethics and morals in animal conduct.


Condensed report of a committee appointed by the governor of Illinois.


Ethical problems in the study of behavior change and proposed measures to mitigate the dehumanizing aspects by being aware of the manipulative aspects.


"Behavioral science may as well resign itself to shallow descriptivism unless it can create the concepts and the methods and techniques required for dealing with statements of value and with non-verbal acts influenced by such abstract standards."


Traditional systems of ethics and their relevance to the choices which a scientist must make in his day-to-day activities.

The ways in which science influences ethics and the scientists' responsibility to society.


"The parallelism that exists between the traditional problems of ethics and those of science."


"Psychological progress in understanding human nature and a scientific ethics."


Remarks "dealing with why and how we should use human experimental subjects."


The two contributions made in the field of religious and ethical speculations by Darwin's theory of evolution.


The tradition of an unwritten code for scientists is seen as outmoded; and rethinking is urged, with emphasis on the ethics of scientific publication.


Some of the issues arising from the "information explosion..."


The responsibilities of medical scientists, the public, and government in maintaining ethical standards.

The "third culture" is that of the social sciences, as opposed to the physical sciences and the humanities.


The need for a new moral code geared to such present problems as the transplantation of organs. (Further discussion in "Clinical Experience Is Tempered by Genuine Human Concern," by John P. MERRILL, 626-627 of this issue.)

ROSEBURY, Theodor. "Medical Ethics and Biological Warfare," PBM, VI (Summer, 1963), 512-523.

Questions the long-term support by physicians of the U.S. program of biological warfare research.


The atom bomb has demonstrated that scientists can no longer devote themselves only to the pursuit of knowledge, but have the responsibility to see that this knowledge is put to proper use for the benefit of mankind.


The issues raised by use of antibiotics to preserve the life of aged and infirm persons.


Discusses: Why do we need thinking beyond science to keep our culture alive and alert? and states that the giant strides in physical science have overrun progress in ethics.


A theologian discusses euthanasia and other moral problems that confront doctors.


Some of the ethical problems confronting the social sciences because of their recent growth.

Argues that the scientist cannot divorce his personal ethical code from his political attitudes and responsibilities.


Raises some of the questions not answered by the physicians' traditional code when involved with world health problems.


Relevance of modern science to modern morality.

VISSCHER, Maurice B. "Medical Research and Ethics," JAMA, CXCIX (February 27, 1967), 631-636.

The morality of experimentation on animals.


Traditional religious doctrine is often inadequately adjusted to problems posed by science for ethics and theology.


Discussion of human ecology and scientific ethics. (Continued in ibid., XXIV, November-December, 1967, 42-47.)


A theologian and a physician discuss the care of the terminally ill patient.
11.3 SCIENCE AND RELIGION


Asserts the supremacy of the scientific way of observing and handling the world over the older philosophical and religious approaches. (See ibid., NIEBUHR, Reinhold, "Limitations of the Scientific Method: An Answer to Pierre Auger," 87, for a rebuttal of this point of view.)


Humanism as the religion of those who accept the conclusions of scientific investigations as their beliefs.


Theologians should examine the intellectual structure and methodology used by physicists to create their models and try to validate their conclusions.


The relationship between science and theology in recent centuries, and a call for a re-construction of current attitudes.


A Christian view of technology and recent statements that are relevant.


The conflicts between science and religion were growing pains as science strove to establish its own place.

FEIGL, Herbert. "Is Science Relevant to Theology?" Zygon, I (June, 1966), 191-199.

Fundamentalist theology is "incompatible both with the most assured results and the most reliable methods of science . . . The much-referred-to religion of great scientists often consists . . . in the belief in the order of nature . . . Intellectual honesty demands a wholehearted acceptance of a scientifically oriented and philosophically clarified humanism."

The orthodox opinion that science and religion were complementary, not contradictory, begun to break down.


"Can the truths of religion be treated as scientific postulates?"


Faith influences all human behavior and faith in the supernatural should not be condemned unless it conflicts with known facts or promotes perverted behavior.

HIEBERT, Erwin N. "The Uses and Abuses of Thermodynamics in Religion," Duedalus, XCV (Fall, 1966), 1046-1080.

A study of "the interaction between thermodynamic thought and religion" during the past century.


"What is there in Christ and in religion which is of interest to science?"


A statement of the place of faith in scientific thought contrasted to the faith of popular religion.


Urges that the criterion of success for theology or physics is the degree of rational coherence.


Views on the relationship of science to religion in the tradition of liberal and 'post-liberal' theology.

Historical appraisal of the causes of the split which occurred during the Enlightenment.


The common tasks of religion and science—to provide more abundant life and to subject power to moral law.


"Revealed religion, whose theological formulation is open to science, can undergird the scientific enterprise by expressing the source of courage to look and think . . . ."


"A clergyman questions the ability of science to fulfill all man's needs."

REISER, Oliver L. and Blodwen DAVIES. "Religion and Science in Conflict," Annals, CCLVI (March, 1948), 132-140.

The tendency of organized religion to remain static in a changing world and the postulates of scientific-religious humanism.


A recognition of the functional existence of a basic, science-influenced world view in our society, and an analysis of the implications for orthodox and for liberal religion.


Four distinguished 19th century philosophical attitudes on the question of evolutionary theory.


Science and religion are both ways to understanding the truth and both are necessary.

"Science and religion are both universal and basically very similar... Understanding the order in the universe and understanding the purpose in the universe are not identical, but they are also not very far apart."


Civilization has reached a new cultural threshold which requires that the resources of science and religion be united if the race is to survive.


Comments upon reception of Darwin's evolutionary theory by some 19th century American thinkers.
Section 12.1 includes items on the place of science in society and on the potentialities of science and technology as instruments for the achievement of social goals. Much of this literature, whether by scientists or non-scientists, reflects a concern for the preservation of humane goals in a technoscientific society. Additional related materials will be found in Sections 4 and 11.1.

Section 12.2 cites articles—for the most part written by scientists themselves—on the ethical and social responsibilities of scientists. Some of the items deal with possible roles of scientists in the political arena. Related materials will be found in Sections 5.2.1.2, 6.5, 7, 11.1.1, and 11.2.

12.1 GENERAL


The need for study of human behavior by the methods of science.


Indicates the dangers in the current disparity between scientific progress and the resolution of social issues, and suggests specific action by scientists in the promotion of human welfare.


Author believes that the common language of reasoning used in science would be a basis for the unification of man.


It is becoming increasingly possible to use the knowledge of how animal and human behavior is initiated and maintained to foster socially desirable behavior.

The application of science to social life and its inability to make decisions and resolve conflicts of values and goals.


Scientific development, which offers great promise for the advancement of human welfare, at the same time threatens it with destruction.

BOULDING, Kenneth E. "Dare We Take the Social Sciences Seriously?" ABS, X (June, 1967), 12-16.

Asks whether we can or should take the social sciences seriously, and answers with a cautious affirmative.


The advance of science is bringing in a new era of social existence, a continuation of the change from barbarianism to civilization.


The technological and ideological impact of science on human life.


The impact of technology upon history.


Bush takes a pragmatic, limited view of progress, arguing that the least science increases knowledge and human comfort, if properly applied.


Man's responsibility to use science for the benefit of mankind and the many opportunities available.

An address by the Chairman of Imperial Chemical Industries, Ltd., in which he discusses careers in science and the application of scientific knowledge to human welfare.


The urgency for applying science to such problems of society as air pollution, water pollution, and crime.


Nine articles on past, present, and future influence of science upon the world view.


Nineteen articles on five topics: Technology and Society; Political Implications; Science and Social Change; Conjunction of Social and Physical Sciences; and The Problem of Values.


The problems posed for men by the technological society and the ethical and spiritual conditions required to resolve them.


The direct and indirect effects of technology on society.


Civilization is endangered by the technocrats who control techniques such as communications, but who understand neither their impact on man nor "the high moral purposes they should serve."


The social and psychological sciences are our only means for integrating modern man into our technological society.
Section 12


The application of science to social issues with a study of migration as an example.


An address describing man's progress and problems as he learns to understand and manipulate natural processes.

HEILBRONER, Robert L. "Do Machines Make History?" Tech Cult, VIII (July, 1967), 335-345.

A discussion of technological determinism.


The need for "an effective world political organization" to contain the threat of nuclear weapons and to marshal the world's resources for aiding underdeveloped countries.


Science and technology are not being used properly to meet the practical needs of our society.


The key to man's future lies in science and depends upon his use and understanding of science.


The nuclear age is the third phase of the industrial revolution and its complexities of discovery and invention have raised social problems which are influencing the development of industry.


Man puts his mark on science with his method of discovery; science influences his thought and through technical discoveries the material development of societies.
"Social accounting" is needed for monitoring and forecasting the effects of science and technology, and would provide a means of evaluating and determining future goals.


The values of science and technology to society, claiming that their techniques perpetuate misery, violence, and destruction.


Contends that the place of technology in man's development has been overemphasized and that it must be subordinated to other facets of human culture if man is to fulfill his basic nature. (See also idem., same title, Tech Cult, VII, Summer, 1966, 303-317.)


The contrasting effects of technology as a collectivizing force and as a means for developing individuality.


Points to need for a new type of scholar, rigorously trained in the humanities and social sciences.


Maintains that science and technology can be utilized for the good of man only within a cooperative social order.

The impact of science on society and the positive aspects of the discontent with the status quo which is characteristic of science and technology.


Urges greater appreciation of the social impact of science and technology.


The role of science in civilization, its present organization and support, and possible future trends in research.


Man's evolution in biological and social terms, including his development of science and technology with its social and economic impacts.


An experiment in California on the possibility of applying systems techniques to public problems.


The need for new social systems to cope with technological advance and specific institutions that might be set up for planning and studying the applications of technology.


Claims that "science has changed from a philosophic and academic pursuit into a vast social and political effort to manipulate man and nature."


"The scientific method, substantially modified, could be used to reach sound solutions to the complicated social, economic, and political problems of the present era."

Changes include the growing conviction that science is a "savior," but popular misgivings continue and science must maintain its integrity in the face of governmental and industrial demands.

_____. "Integration of Science and Society," ABS, VI (December, 1962), 3-6.

Points out the dangers of the misuse of science and suggests methods for the constructive use of scientific accomplishments.


Although technological solutions to social problems tend to replace one social problem with another, "the Technological Fix accepts man's intrinsic short-comings and capitalizes on them for socially useful ends. It is therefore eminently practical and in the short term relatively effective." (See also, idem., same title, in BAS, XXII, December, 1966, 4-8, and in ABS, X, May, 1967, 7-10.)


The importance of scientists understanding that "we need nothing physical half so much as we need better understanding of men and of human affairs."


Science enlists men unequally in different parts of the world and it does not make the contributions it might to sociological and political ideas.

12.2 SOCIAL RESPONSIBILITIES OF SCIENTISTS


Compares the utopianism found in these so-called "ideal commonwealths."


The work of Walter G. WHITMAN, then Science Advisor to the Secretary of State.

The impending crisis in the relationships between science and the American society means that the AAAS take immediate action on major social issues of scientific origin.


The primary responsibilities of the scientist to society are to inform and to educate.


Scientists must communicate with laymen if the discoveries of science are to be used for the benefit of mankind.


A report on a conference of the Scientists' Institute for Public Information.


The new status of science, considering support for research, the need for more scientists, the spread of science, the social responsibility of the scientist, and the place of basic research.


The proceedings of international discussions on science and human welfare held at the centennial celebration of the Massachusetts Institute of Technology.


Scientists should make their knowledge and research results available to the layman to improve their relations with society.
Suggests possible contributions from psychiatry and psychology and states that personal responsibility involves the daily improving of local human relations.


Participation in community affairs by scientists may give them common ground with politicians and help close the gap between science and politics.


Explores two tasks of scientists: (1) educating the general citizenry to face problems involving the uses of science; (2) converting expert scientific knowledge into proposals for political action to meet those problems.


Reviews two conferences on science and world affairs.


The international situation would improve if men of science would consider their situation honestly and act in accordance with their findings.


The scientist's role is "... to contribute by all means in his power to contemporary culture."


The professional, intellectual, and social responsibilities of biologists.


The importance and responsibility of botanists in the life of mankind.

Berates the scientific community in general for a lack of social conscience and cowardice in the face of political pressures.


An address to the convention of Sigma Xi, describing the current environment of science and its ever-closer connection with social and economic issues.


The responsibilities of scientists to communicate with laymen, to participate in public service, and to educate the public and the government in the basic facts of science.


Extracts from a presidential address to the Royal Society of Britain dealing with the relationship of the scientist to society.


The protest of American scientists against use of chemical and biological weapons in Vietnam, and a Pugwash scheme for international inspection of microbiological laboratories.


On the nature of science and the ethical problem posed by its public image as contrasted with its actual character.

IHDE, Aaron J. "Responsibility of the Scientist to Society," *Sci Mon*, LXXVII (November, 1953), 244-249.

In return for the freedom to choose his own field of investigation and make his own decisions on conceptual matters, the scientist is obligated to make his findings public and work for social good.

Science "has the direct and pressing responsibility of supporting cooperation between the nations of the world in spite of the political and social differences which beset them."


Possible negative features and consequences of social-psychological research, which could be diminished by the commitment of social scientists to an active role in the humanization of society.


"American scientists have a clear duty to keep themselves informed about what is going on, and by individual and collective action to make their voices heard."


All the factors which hinder the behavioral scientist from taking a responsible social role are discussed.


History and guiding principles of the Pugwash conferences.

LONG, F. A. "Scientists in Foreign Affairs: Where Do We Go Now?" BAS, XXIII (March, 1967), 14-18.

Past and future contributions of scientists to issues of foreign policy, disarmament, and economic development.


The relation of the scientist to social issues and the basic nature of his role as scientist. (See answer by Read BAIN, "The Scientist and His Values," Soc Forces, XXXI, December, 1952, 106-109.)
The heretic or critic who has a scientific attitude toward questioning and testing is indispensable to freedom.

Scientists need to establish writing concepts between sciences and between science and the arts.

Historical examples to support the view that doctors should take an active part in political life.

The nature of the problems raised by the role of the technical expert in a democracy, and the need for developing an ethic of responsibility.

In the face of ignorant fear the scientist must stand firm on civil liberties, particularly on freedom of the mind.

The three conferences for consideration of the social, moral, and political implications of science.

The scientist is a citizen who has a public duty to see that his discoveries are used ethically and serve the public interest.
SACHS, Robert G. "Power of Prediction--An Example," BAS, XX (December, 1964), 20-

A 1945 report of the author points to "the power of prediction that is in the hands of the scientist."


The responsibilities of scientists for the problem of world developments.


The relationship between science and value, value positions for social scientists, and the role of the social scientist in society, especially with regard to research on large organizations.


The delicate relationship between science and politics requires a mature and intelligent response from the scientist.


The history and accomplishments of the Pugwash Conferences on Science and World Affairs.


Both scientists and non-scientists now consider the social consequences of scientific ventures.

STAKMAN, E. C. "Science and Human Affairs," Science, CXIII (February 9, 1951), 137-140.

The role of the scientist as citizen and the charge that science "dehumanized" knowledge.


The scientist has a moral duty to make known to the layman as much of his work as possible, and to do so, he must write simply.

The Pugwash Conferences, "a movement among scientists seeking an international exchange of ideas on the impact of science on human affairs."


The impact of science upon society presents a challenge to the social sciences to learn more about "power relations among men and the means for generating the will and the capacity for action directed toward the achievement of a good society."


It is still the responsibility of the scientist to conduct his research so as to serve the welfare of humanity.
GUIDE TO INDEX

In the interests of brevity and for efficient use of the bibliography, the following index devices have been employed. The user should become familiar with these, and especially with the abbreviations of the fifty journals covered in the bibliography and listed at the end of this guide. In general, articles are indexed only under the authors' names. The detailed classification of the items indicated in the table of contents serves as a subject index.

(1) Year of publication.
Because the bibliography covers material published from the beginning of 1945 to the end of 1967 only, the first two digits of the year have been omitted. Therefore "65" appearing immediately after the journal name indicates that the article was published in 1965.

(2) Cross-indexing.
(a) With very few exceptions where the article was indispensable to more than one classified topic, there has been no cross-indexing of subject matter, each article appearing in the bibliography only once. Thus the figure "298" immediately following the two digits of the year of publication indicates the page on which the article is described.

(b) Articles by two or more authors are indexed under each author, but in different form. When indexed under the first, or primary author—the form in which the article was published—the item will appear as "PARKS, Larry G. and Stuart S. DYE." When indexed under the second, or subsequent authors, the form used is "DYE, Stuart S. (PARKS, Larry G. and Stuart S. DYE)." Thus such a parenthesis always indicates that the index item is being listed under a secondary or subsequent author's name.

In this way a user who may not know the name of the primary author is certain to find the article, and he will also find it easily when consulting the journal.

(3) Identification of authors.
The names of authors do not always appear in the same form in all of their publications. Sometimes initials are substituted for given names; names may also be given fully or only in part. Pseudonyms are occasionally used. So far as possible, all items by the same author have been listed under a single author entry. But if it could not be established that authors with similar names or initials were the same individuals, separate listings have been provided.
(4) Titled English authors.

Because many of the journals are either published in Great Britain or follow English usage, the following adaptations have been made between English and American usage in regard to titled authors.

(a) The title of "Sir" has been omitted entirely.

(b) If the title is the same as that of the author's family name, it appears after the name in parentheses. An example is: "SNOW, C. P. (Lord SNOW)."

(c) If the author's title is different from his family name, the author is indexed under his family name with the title following in parentheses. Thus, the form is: "HOGG, Quintin McGarel (Lord HAILSHAM)." However, since titled authors are often published in Britain only under their titles, in such cases "HAILSHAM, Lord," is included in the index with the reader directed to look for the article under "HOGG."

(d) Articles by Prince Philip, the husband of Queen Elizabeth II, are indexed under "PHILIP, Duke of Edinburgh," which is customary usage.

(5) Grouped articles.

In a number of instances articles by the same author pertaining to the same subject are grouped together in the annotation; especially if they appeared in the same journal. The editors not infrequently encountered substantially identical articles by the same (often prestigious) authors under different titles in different journals. Nothing would be gained by separate annotation of these essentially identical articles. Less frequent groupings include articles by different authors who hold opposite points of view on the same subject; short articles pertinent to the subject matter of the indexed article; and articles which are replies to an exchange of letters. Such items mentioned in the annotation are indexed under the author's name. These groupings were made to conserve space and to direct the user's attention to immediately useful material on the subject.

(6) Entire issues of journals.

A number of "entire issues" of journals are included in the bibliography, and frequently the individual contributors and the titles of their articles are mentioned in the annotation. An example of this is "ABELSON, Philip et al. "Science in the U.S.S.R.," Science, CXXVI, (November 29, 1957). In such cases these contributors are not indexed separately because either the entire issue pertains to the subject, as in the case above, or it was considered sufficient to index such articles under the name of the editor of the issue.
Journal abbreviations.

Most of the abbreviations in the following list are those used in standard library procedure; in a few cases of lesser known journals, such as nos. 25 and 32, the editors simply chose abbreviations which not only seemed appropriate, but would distinguish them from the abbreviations of journals having similar titles. Single-word journal names were not abbreviated. Quick memorization of the abbreviations will greatly expedite the use of the bibliography.

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<td>2. American Behavioral Scientist</td>
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<td>3. American Political Science Review</td>
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<td>4. American Scientist</td>
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