

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

March 10, 1954

To the Board of Trustees:

In the years from 1948 through 1953, the work of the Institute for Advanced Study has grown, not dramatically, but steadily. Our Faculty has become larger; our annual membership has increased; we have added new buildings. The increase in our expenditures summarizes the quantitative aspects of our growth: In the academic year 1947-48 the Institute spent some \$600,000 of its own money, and \$225,000 of funds contributed by other agencies, principally by departments of the United States Government and by foundations. In the academic year 1952-53 the Institute spent about \$800,000 of its own money; and the contributions of other agencies to our operations had risen to almost \$400,000.

There have been some changes of emphasis as well. There has been a marked increase in our work in theoretical physics, and a very substantial increase in applied mathematics. We have broadened our activities in historical research, and at the same time sought a greater degree of unity in historical studies. We have also embarked on work on some fields hitherto not touched at the Institute, though we remain an institution which, for reasons of design and purpose, or for reasons of limitation of funds, or for reasons of historical accident, works intensively in some fields of science and scholarship and little or not at all in others.

The account which follows will attempt to sketch in broad terms the scope and nature of our scholarly activity, with particular reference to those undertakings that are new, or those changes in emphasis and policy which have evolved in the period covered by the report. In making this report some unevenness is inevitable. One cannot describe in intelligible lay terms the work of pure mathematicians or theoretical physicists with the same vividness and immediacy with which it is possible to talk of work in applied mathematics or modern history. Thus the attention devoted in this account to the various phases of the Institute's work cannot be a true reflection either of the quantity or of the importance of that work. What we say about abstruse subjects will remain abstruse in summary; what we say of more generally understandable ones, though still brief, may come a little closer to indicating content and achievement.

The Institute is composed of two schools, a School of Mathematics and a School of Historical Studies. An account will be given later in this report of the deliberations which led to this arrangement. In each school there is a Faculty of senior scholars of eminence, who are appointed until the time of their retirement and who often continue to work as active scholars and members of the Institute long after their retirement. The Faculty of each school elects the members of the school to terms of membership which may be as short as a semester, which are typically a year or two, and which in rare cases may be for five years or for even longer periods. All Faculty appointments and all appointments of long duration require the approval of the Trustees; but the election of temporary members rests with the Faculties, except insofar as policy and budgetary determinations of the Trustees may limit the choice. There are some twenty scholars at the Institute who are not members, but who are employed as assistants to professors, or who work as scientists on our projects in applied mathematics.

SCHOOL OF MATHEMATICS

Pure Mathematics. In the School of Mathematics scholars of all ages, with varying degrees of flexibility and maturity, come to teach and to learn whatever seems to them to be significant. The exchange is as much between the visiting members as between these visitors and the professors of mathematics. Some of the most important critical and educational contributions to mathematics occur in the many seminars conducted here by members. There is intensive collaboration in research. In the last years Professor Morse, for example, has written some twenty papers in collaboration with visiting members of the Institute.

The mathematics Faculty of the Institute has contributed its share to the creation of the moving mathematical ideas of our day. This has been generally recognized, particularly in the fields of logic, number theory, information theory, topology, and in the influence of variational theory on topology. The lectures—given each fall—by Jean Leray (also professor at the Collège de France), have made an historic impression in the field of partial differential equations. Professor Weyl continues his lectures at the Institute each second term, giving freely of the wealth of his great scholarship.

In bringing young mathematicians here from Europe the Institute has depended heavily on the knowledge of the European scene of Professors Weyl and Leray, and of Professor Heinz Hopf of the University of Zurich. The results have been most fortunate. More and more, distinguished mathematicians elect to come to the Institute on sabbatical leave. Often Institute funds are used to help support these members.

During the period covered by this report there have been some 300 mathematicians who have been members of the Institute. They come to us not only from the United States, but from almost all parts of the free world, from Western Europe, from Latin America and from Asia. Their work has resulted in the publication of more than 500 papers in the learned journals of mathematics. Their association with the Institute has in many cases greatly broadened the mathematical background of the members and thus helped the progress of mathematical science in the universities and institutes here and abroad from which the members have come, and to which they have returned. A few scholars, coming here from abroad, have accepted chairs in leading universities in this country.

During the last six years five mathematicians have been made professors of mathematics at the Institute for Advanced Study.

Kurt Gödel became a permanent member of the Institute in 1946, and professor in 1953. His achievements in modern logic have been monumental. He was the first rigorously to establish indesmonstrability within mathematics proper. His methods in logic are studied wherever logic is studied. Recently he has turned his attention to problems in relativistic cosmology, as well as to logical problems in philosophy, with particular reference to Leibniz.

Deane Montgomery became a permanent member of the Institute in 1948 and professor in 1951. He had previously been an assistant professor at Smith College and more recently an associate professor at Yale University. His main interest has been in topological groups, including Lie groups, in transformation theory and related fields. His recent work has been brilliant; it is so recognized throughout the world, and is attracting scholars to the Institute from many lands.

Atle Selberg became a permanent member of the Institute in 1949 and professor in 1951. His earlier studies led him into the congenial mathematical company of Carl Ludwig Siegel. His scientific production, centering in analytic number theory, is deep and extensive. Under his influence, supplemented by that of Baurling, the Institute has become a center of study in analytic number theory.

Hassler Whitney rose from the rank of instructor in mathematics at Harvard in 1933 to professor in 1946. He became professor at the Institute in 1952. His interest has been mainly in topology and its applications to differential manifolds. He is fundamentally a pioneer with profuse and fruitful ideas. Recently he has been led to a theory of r -dimensional integration.

Arne Baurling came to the Institute as a member in 1951, and has just been appointed professor of mathematics. From 1937 to 1951 he was professor of mathematics at Uppsala. He had established himself as one of the great leaders in modern mathematics long before he came here. He has originated some of the most fertile ideas about conformal mapping, harmonic analysis and analytic number theory. His presence here gives additional breadth and unity to the mathematical influence of the Institute.

Theoretical Physics. In the years 1948 to 1953, there has been a marked growth in the work of the Institute in theoretical physics. This was a natural development for the Director to undertake. It has been supported throughout by Faculty and Trustees. The Institute has always had a few

members interested in theoretical physics; this was inevitable in a school of which Einstein was a first member, and which Pauli and Bohr visited from time to time. But both the scope and the character of the work have changed. We have appointed two professors, Freeman Dyson and Abraham Pais; we have made arrangements for a continuing or recurrent association with the Institute for a number of physicists: Niels Bohr, P. A. M. Dirac, Res Jost, G. Placzek, W. Pauli, L. C. Van Hove and C. N. Yang. The number of annual members has increased rapidly; in 1953, we had about 25 men in this field working at the Institute; and in the whole period, we have had about a hundred such members. Their work has eventuated in the publication of between one and two hundred papers in the Physical Review and--to a more limited extent--in other technical journals.

The members in physics come to us from many places, and in many different stages of their work. A few of the most brilliant post-doctoral students in the country come here for a year or two of further study; a few come to us on leave from assignments involving serious administrative duties with the government or with industrial laboratories, and have an opportunity both to complete work which they have wished to undertake, and to learn of the new things that are under development. Many are scientists from abroad. In fact, it was in physics that we first re-established effective and continuing contact with the Japanese scientists. We have had a few brilliant young Chinese, who have immigrated from China after the war. Members come from India and Pakistan, and from almost every country of Western Europe. Very often members in physics, as in other subjects, have the support of their own governments, or of an agency of the United States Government, such as

the National Science Foundation, or of fellowships given by American universities or foundations.

The work in physics is coherent, but not organized. There are seminars of two kinds: one is a continuing seminar, meeting weekly or bi-weekly whenever the Institute is in session, on problems of high current interest, on the work of members, or on work done elsewhere which we need to hear and discuss at first hand. The other seminars are devoted to a single theme, usually one which is in need of critical review and analysis, and may continue for a month or a semester or more. Examples are superconductivity, semiconductivity, group theory of nuclear energy levels, and the solubility of the equations of quantum field theories. It is appropriate to mention a few examples of achievement of physicists permanently associated with the Institute. Dyson has made searching analyses of the mathematical consistency and meaning of the fundamental theories of matter. It was he who first showed in what sense the quantum theory of electrons and electromagnetic radiation could be interpreted in a mathematically coherent way to explain a vast range of physical phenomena. He has initiated searching enquiries as to the ultimate consistency of the theory of nuclear forces and made important advances in the application of this theory to the most recent experimental findings.

Pais has for many years devoted himself, among other things, to the problem of the nature and structure of the elementary particles of physics. Some of his major contributions have been critical and negative, in showing that earlier suggestions describing the structure in space and time of primordial problems were neither logically consistent, nor in agreement with experience. His most recent efforts have been devoted to a new description of the structure of matter, which at

best is only a first step in the solution of this great problem, but which does throw some light on the true properties of these objects as they are observed in nature. It is probable that a real solution or even a major advance in the description of elementary particles and their interaction is a task which will take years for its accomplishment, years of mathematical improvisation on the one hand, and of analysis and synthesis of experimental findings on the other.

Flaczek has continued brilliant, critical, and successful studies of scattering phenomena, particularly where they are determined by the properties of matter in bulk, of crystals and liquids. He has brought order and enlightenment to many of the darkest corners of this field.

Yang's work has touched on so many themes and with such success that a summary is inadequate. His contributions range from the theory of elementary particles and their stability, to the problems of order and disorder, ferromagnetism, and the theory of condensation and of changes of state.

The principal subjects of work in theoretical physics at the Institute have had to do with the structure, nature, interactions, description and theory of the primordial particles of which matter is composed. But there has been much work of a methodological nature, especially in quantum electrodynamics and in the so-called meson theory of nuclear forces. There has been work on classical nuclear physics, on statistical mechanics, on problems of order and disorder, condensation, the solid state and the strange phenomena of superconductivity and superfluid helium. In a few cases there has been fruitful collaboration between theoretical physics and pure mathematics; and among many members

there is a substantial community of interest and knowledge between these two disciplines.

Applied Mathematics - The Electronic Computer. In 1946 John von Neumann had organized a group to develop and construct at the Institute a large-scale, high-speed electronic computing instrument which could be used as a new tool for the mathematician. In view of the difficulties that beset researchers in the field of non-linear mathematics for the last half century, an electronic machine of suitable size and speed may be used toward gaining those heuristic insights which are the first steps in the direction of an exploration of a field. With the goal of obtaining a machine with adequate characteristics, the group undertook an engineering research and development program which culminated in January, 1952 with the completion of a machine. This machine was the prototype for a number built by various government agencies. It has also contributed ideas to a number of other groups which have produced comparable instruments.

Concurrent with the engineering program, another small group studied the logical problems connected with the design of the machine and the final instrument reflects the interplay between the two groups.

As a continuing effort, some mathematicians have been working with von Neumann to develop those numerical techniques required by the particular characteristics of the new machines. They also make extensive use of the machine to test out these techniques. A variety of problems has been run, including some of interest to the pure mathematician, as well as a considerable number of interest to

the applied mathematician. These include number theoretical, hydrodynamical and astrophysical problems, as well as the meteorological work described below.

Since the completion of the machine, the major emphasis of the entire project has shifted to operation of the machine and to further improvements of its organization and components. These activities are proceeding in a cooperatively fruitful fashion.

The Institute has been fortunate in being supported in these activities by a number of government agencies that have a great interest in computational problems. Its major efforts, the machine construction and operation programs, are supported by the Ordnance Corps, U. S. Army; the Office of Naval Research, U. S. Navy; the Air Research and Development Command, U. S. Air Force; and the Atomic Energy Commission under contracts with the Ordnance Corps. The Institute has each year made substantial financial contributions to this program. The mathematical work has been sponsored by the Office of Naval Research, U. S. Navy, since 1947.

The planning and construction program has been made possible by the joint efforts of Julian H. Bigelow, Herman H. Goldstine, James H. Pomeroy and John von Neumann, together with a staff of electrical engineers.

Applied Mathematics - The Meteorology Project. The Meteorology Project was established concomitantly with the Electronic Computer Project in 1946, with the expectation that the computer would be a powerful research tool in the investigation of fundamental problems in dynamical meteorology, and would make possible for the first time a direct attack on the problem

of weather prediction by numerical solution of the hydrodynamical and thermodynamical equations governing the motion of the atmosphere.

It was decided in 1948 that the complex of mathematical and physical problems of numerical prediction could best be solved by studying in turn each of a sequence of successively improving idealized mathematical models of the atmosphere. Despite the very simplified character of the first models, results of considerable theoretical and some practical interest were obtained as early as 1949. The first attempt to use an electronic computer for numerical prediction was made in 1950 on the Eniac, an instrument made available by the Ballistic Research Laboratories of the Aberdeen Proving Ground. The results were encouraging and led to the construction of models of greater complexity for use with the Institute computer. After its completion in January, 1952 the Institute computer was used extensively for a series of numerical experiments which culminated in early 1953 with the development of a model by means of which one was able to solve the problem of the prediction of storm generation (cyclogenesis), the chief obstacle that had stood in the way of accurate weather prediction. With respect to this, our crucial experiment was the correct calculation of the great Appalachian storm of November 25, 1950. Similar success was also obtained in the two subsequent calculations of this type that were undertaken: Those of the storms of November 12, 1952 and of November 5, 1953, both in the eastern United States. At this stage there was no longer any doubt that these numerical methods were more accurate than all existing, standard methods. Therefore, the civil and military weather services of the United States Government decided in late 1953 to organize a Joint Numerical Weather Prediction Unit in Washington, D. C. to put into practical operation the methods developed by the Project.

Concurrently with the short-range prediction studies, a series of investigations were made of the factors governing the long-range evolution of weather. These studies are essentially attempts to understand what produces the circumpolar band of strong westerly winds at middle latitudes and their quasi-stationary mean perturbations. It was demonstrated, that the traveling low- and high-pressure systems (cyclones and anticyclones) act as turbulent eddies transferring the potential energy derived from solar radiation into the kinetic energy of the mean westerly winds, and thus maintaining them against frictional dissipation. The study of the effects on the mean air flow of friction, heating, and continental obstacles led to a theory which is in encouraging agreement with the observed perturbations of the westerlies.

The work of the project has stimulated meteorologists elsewhere toward similar efforts in numerical meteorology. There are now active centers of academic research in this field in England, Norway, Sweden, Denmark, Western Germany and Japan.

The project was supported financially originally by the Office of Naval Research, and since 1951 jointly by the Office of Naval Research and the Geophysics Research Division of the Air Force Cambridge Research Center. It has had the good fortune to secure the collaboration of visitors of outstanding ability from the Universities of Chicago, Oslo, Stockholm, Copenhagen, London and Tokyo, and from the United States Weather Bureau.

The Meteorology Project has been under the immediate direction of Charney and von Neumann. Important contributions were made to its work by H. Phillips and several temporary members, of whom A. Eliassen, R. Fjørtoft and J. Smagorinsky should be particularly mentioned. The advice of C. A. G. Rossby, now at Stockholm, generously given throughout

the years, has been most valuable. The work of the Institute in applied mathematics has received valuable support by a gift of the International Business Machines Corporation of \$20,000 a year for five years, since 1949.

SCHOOL OF HISTORICAL STUDIES

There is no work in the School of Historical Studies as extensive—and at the same time concentrated and coherent—as that in pure mathematics or in theoretical physics. We do not in any sense "cover" historical studies, as we do try to cover pure mathematics. What we have sought is to encourage work in areas of historical research which are manifestly fruitful, and in which a very high level of scholarly excellence, intellectual interest and fundamental historical discovery are assured.

Archaeology. The scholarly resources of the Institute play a growing part over a wide range in the fields of Greek Archaeology and History. The library, as it becomes increasingly adequate and useful, the files, records and pictures of current excavations, and the opportunities offered to scholars from abroad have all made this a center for work in the classical fields. The results of research initiated in other institutions, and new material from current excavations are gathered, assimilated, subjected to comment and criticism and presented through publications to both scholarly and lay audiences. The fruition of such cooperation and collaboration is proving to be far richer than the work of an isolated scholar.

This work has not been limited to any single period. In the field of Prehistory, Professor Goldman and her collaborators have been studying and publishing the valuable results of the excavations at Tarsus in Asia Minor. Professor Wace, formerly of Cambridge, during the past few years has been illuminating, by his excavations at Mycenae,

which he studies and publishes here, the earliest stages of Greek civilization. In the general field of Greek history work has recently been done on the early history of Greece, on Ionia, on papyrological problems, and on the calendar. Publications by the American School of Classical Studies at Athens, whose headquarters are maintained at the Institute, have included works on excavations, on mediaeval castles and on early travelers in the Levant.

Attention is being given particularly to the publication of recent discoveries in Greece, especially those at Corinth and Athens. Members of the School of Historical Studies who come to work with Professor Meritt or Professor Thompson have assisted in evaluating this new material. Many of these have come from Oxford and Cambridge, others from the Greek Archaeological Service, and a good number from France, Holland and other parts of Europe.

One large field of study which occupies many members is the history of the ancient city of Athens. The records of the Agora Excavations of the American School of Classical Studies, of which duplicates are now housed here, provides a wealth of material on all subjects. Professor Meritt and his associates have concentrated on the epigraphical documents, of which they have a unique collection of copies. These they have used as a basis for the study of the Athenian tribute lists and thus put on a sound basis that important field in the history of fifth century Athens. They are also studying the statistics and personnel of the Athenian population. Since the new documents from Athens alone amount to some 6700 items, the possibilities inherent in the publication of this body of material are very great. The political, financial, and military history of Athens is therefore continuously under re-examination by the various members from year to year.

Professor Thompson and his associates devote themselves chiefly to the study for publication of the other material from the Agora Excavations. Professor Thompson directs not only the field work in Athens, for which he is given leave of absence by the Institute, but he organizes and supervises the publications. With the collaboration of a number of members, he is directing the study of ceramics, sculpture, numismatics, literary testimonials, and various minor arts. He himself makes the topography and architecture his especial interest. He also endeavors to make all aspects of these studies available to the layman, by giving illustrated lectures and by writing for more popular journals. In this way, the results of scientific investigation are brought to bear upon the work of scholars and upon the thought of the people of today.

In the period covered by this report, some forty members have worked at the Institute on archaeological problems.

Greek Philosophy and Science. Knowledge of the ancient Mediterranean world and especially of ancient Greece is significant and important not only because modern European or Western civilization is a lineal descendant of the Greek but also because the development of Western thought and institutions even during the Middle Ages, and especially since the Renaissance, has repeatedly been inspired and influenced anew by direct contact with the literary and artistic monuments of that ancestral civilization. Greek philosophy and science, in the broad ancient sense of these terms, are the integrating factor of that ancient civilization itself and of its flowering in Western civilization. In 1948 it was decided to make provision for these studies and so to supplement the work in Greek history, archaeology, and epigraphy already being intensively

pursued here; for this purpose Professor Cherniss was appointed. From 1949 onward an increasing number of scholars working on special problems in ancient philosophy and science have come on annual appointments to the Institute from various universities in this country and in Europe and have worked in consultation with Cherniss and in occasional, informal seminars.

Besides the work done by Cherniss and in consultation with him on Plato, Aristotle, and the ancient interpretations and developments of their philosophical and scientific thought, special studies have been made of the sources for the history of ancient philosophy. This is a subject complicated by problems of text and interpretation and in many cases requires at the outset new editions. Some of our members have devoted their time to the preparation of such critical editions of Diogenes Laertius, the fragments of Theophrastus, and the philosophical and scientific essays of Plutarch. Others have concerned themselves more especially with the transmission of Greek philosophy and science through the two main intermediary literatures, Arabic and Latin. Thus the tradition of Greek thought has been studied on its way to medieval Europe by the indirect as well as by the direct route.

Ancient Astronomy. Certain aspects of the Mediterranean scientific activity that antedate the Greek, and of the influence and counter-influence of ancient Greek and non-Greek science, have also been intensively studied. Professor Neugebauer, who was a member of the Institute several times before 1948 and who since 1948 has been in residence regularly for one term out of every four, has worked with other members on Greek, Muslim, and Hindu astronomy and mathematics, has collaborated with another member

in the publication of a book on the Greek calendar, and has recently completed his monumental corpus of Astronomical Cuneiform texts. A popular account of Neugebauer's brilliant work has been published by him in "The Exact Sciences in Antiquity."

Palaeography. Meanwhile the technical aspect of Latin literary transmission continues to be studied. Professor Lowe, though he has been emeritus for some years, has steadily proceeded with the publication of his definitive work on Latin palaeography, the Codices Latini Antiquiores, the sixth volume of which appeared in 1953. Other members have worked with Lowe on special problems in Latin palaeography or have themselves applied the principles of this science, which he has done so much to advance, to the edition of mediaeval Latin texts. Lowe's intensive and fruitful work well illustrates how little in fact retirement from the Institute's Faculty terminates or disrupts a scholar's professional life.

Mediaeval History. Mediaeval History, for the first time permanently represented through the appointment of Professor Kantorowicz in 1951, has during the last years been the field of interest of nine temporary members besides those engaged in mediaeval art and musicology.

The great problem of transition from Late Antiquity to the Christian Age as well as that of the continuity of the classical tradition in both Byzantium and the West has naturally attracted the attention of several members. A major work on the notions Reformation, Renovation, Renaissance has been begun at the Institute and has yielded a number of preliminary studies in which the patristic background of these notions

has been disclosed. Two studies on Image Worship and the ensuing Iconoclast Controversy in Byzantium were published in connection with the edition of source material relevant to that problem. Imagery was a matter of politics, and its political character has led to studies on the Ruler Image in late antique and Carolingian times. While the continuity of the antique Ruler Cult in Christian guise formed the subject of several studies, Mediaeval Learning has not been neglected: some of the leading Theologians and Scholars of the Carolingian period have been studied by a temporary member, and another scholar devoted his time at the Institute to the study of the literary and pictorial sources of Students' Life at mediaeval universities.

Mediaeval studies have their peculiar difficulties. The advantages of classical scholarship with its long tradition of textual criticism, its highly developed and well organized apparatus of auxiliaries and its relatively limited literary sources are not available to the mediaevalist; nor can he approach his subject from a limited political or diplomatic point of view, as would seem justified in the case of the modern historian. Problems of religion and dogma conditioned that period in its entirety, and there is little hope of understanding the complexity of mediaeval political problems without the concurrent study of theology, liturgy, scholastic philosophy, or canon and civil laws with their glosses. Legal and theological sources, however, have yielded a considerable amount of new information for a number of studies devoted to Constitutional History, and have been of major importance for a book on mediaeval Political Theory, or Political Theology, which is nearing its completion.

Intellectual history and the history of political ideas, however, did not monopolize mediaeval historical studies. In addition

to the evaluation of literary texts, which an eminent European scholar could continue at the Institute, and studies on Chaucerian England, the Texts themselves called for scholarly editing. Texts, badly edited or not edited at all, must be made accessible by means of critical editions, and this philological work remains an important task of the mediaeval historian, whose work in this respect is akin to that of the classical scholar rather than of the modern historian. A new, and perhaps the final, edition of Geoffrey of Monmouth's fabulous, if influential, "History of the Kings of Britain" has been published with the support of the Institute. A source related to the times of the Investiture Struggle occupies a temporary member, while another visitor is engaged in the edition of some hitherto poorly known Political Writings of the later Middle Ages.

There is no lack of variety in mediaeval studies, and the Institute has proven to be a good place for them. For in all those endeavors the exchange of ideas and material with other members engaged in the study of Paleography, Mediaeval Art and Music, or in that of Near Eastern--Iranian and Arabian--Philosophy has proved to be invaluable.

History of Art. During the last six years the group of scholars exclusively or preponderantly engaged in art historical studies included, in addition to the two permanent members (Professor Panofsky and Professor Weitzmann), fifteen members, among them leading art historians from France, West Germany, Holland, and Sweden.

Since works of art reflect cultural situations in all their aspects, the research of this group was varied and strongly individualized in subject matter and scope. While considerable emphasis was placed on

factual problems solvable by means of archaeological investigation, stylistic analysis, and iconographic interpretation, no less attention was paid to the study of the interplay between art and literature, theology, philosophy and science; in this respect the peculiar character of the Institute, favorable to the cooperation of scholars and scientists active in widely different fields, proved to be of inestimable advantage. On the other hand, the work of the individual members, for all its independence, frequently overlapped or interpenetrated owing to an affinity of subject matter, and was always unified by personal contact and a community of methodical convictions. We have tried to avoid the danger of dilution and over-expansion by subjecting our work to the requirements of a strictly historical discipline and by restricting it to the spatial limits of the Roman Empire and the temporal limits of the periods known as the Middle Ages, the Renaissance, and the Baroque.

The work of the group encompassed mediaeval architecture (including its relation to contemporary thought and its evaluation in later centuries), book illumination, sculpture, glass painting, and what our own age somewhat unfairly refers to as "the minor arts"; Early Christian and Byzantine painting and book illumination; Northern painting and book illumination in the 15th and 16th centuries; Rembrandt and his Netherlandish contemporaries. On the other hand, intensive study was devoted to such more general problems as classical survivals and revivals in post-classical art and literature and the changing theological and philosophical attitudes towards the visual arts. In the last two years a successful attempt was made to bring the music of the Middle Ages, the Renaissance and the Baroque into the orbit of art historical studies.

A great number of art historical books and articles published between 1948 and 1953 resulted, wholly or to an essential part, from the authors' activities at the Institute. Mention may be made of three important books on Early Christian and Byzantine painting and book illumination by Professor Whitman (Princeton, 1947, 1948, 1951); Dr. de Tolnay's Michelangelo (Paris, 1951); of Professor George H. Forsyth's monumental monograph, The Church of St. Martin at Angers (Princeton, 1953); and, of Professor Panofsky's Early Netherlandish Painting: Its Origins and Character (Cambridge, 1953; developed from the Charles Eliot Norton Lectures delivered at Harvard University in 1947-1948).

Modern History. The work in modern history has prospered. It has been strengthened by the election to the Faculty of Sir Llewellyn Woodward, and by the continuing and recurrent memberships, among others, of the distinguished British historian, C. Veronica Wedgwood, and the French Geographer, Jean Gottman. Professor Earle has continued with his well-known seminar method which he developed in the early days at Columbia. He has conducted seminars on the "Dynamics of Soviet Policy," on the "Causes of American Entry into the First World War," on the "Decline of Liberalism as a Political Philosophy," and on "Modern France." The scholars who have come to attend these seminars have of course in the first instance continued the researches in which they had been engaged. The seminars have served to stimulate, to correct and to collate. There have been some forty members during these years in the field of modern history, including a few who, like Kennan and Feis, have first come as stipendiates under the Director's Fund, as will be described below. These memberships have led directly to the publication of some twenty

volumes and have contributed to the publication of some twenty others.

Since his election to membership in the Institute, Sir Llewellyn Woodward (who was previously Professor of Modern History in the University of Oxford) has been working on a "History of England from 1906 to 1926." He has chosen this period because it covers the years immediately before and after the First World War, and thus provides an opportunity of estimating how far this war accelerated or retarded political, social, and economic developments in Great Britain. Sir Llewellyn Woodward's history will comprise three or four volumes, of which one volume is practically complete.

Sir Llewellyn Woodward is also editing (with Mr. Rohan Butler of All Souls College, Oxford), at the invitation of the British Foreign Office, a series of volumes of "Documents on British Foreign Policy, 1919-39." Six of these volumes--dealing with British policy in Europe in 1938-39--have appeared since Sir Llewellyn Woodward's membership in the Institute. Other volumes are in course of publication. Owing to the nature of the material this editorial work has to be done mainly in the archives of the British Foreign Office, and for this purpose Sir Llewellyn Woodward has visited England each year during the long vacation of the Institute.

THE SCHOOLS AND THE DIRECTOR'S FUND

Until 1948 the academic life of the Institute was divided into three schools: a large and growing School of Mathematics, which included applied mathematics and physics and was to include more and more of them; a relatively small School of Humanistic Studies, concerned with, but not confined to classical archaeology, paleography and the history of art; and a School of Economics and Politics, with three professors of economics and one of modern history. Circumstances were soon to change. Professor Riefler resigned to re-enter the Federal Reserve System; Professor Warren died; and Professor Stewart retired, and now serves on the President's Council of Economic Advisers. But even before these events had changed the complexion of the Faculty, we had had serious consideration of the proper direction of the work of the Institute in fields other than mathematics and physics. We were led to doubt whether the Institute, limited in facilities for statistical and economic research, divorced from students and from current affairs, was a likely site for systematic, continuing advanced work in economics. It obviously is and has remained a desirable place for many economic studies of limited extent, and for economic history.

We further became convinced that the unifying and invigorating element of work in history and the humanities must be the conscious and scrupulous use of the historical method; and that a school devoted to this purpose would, for all its heterogeneity, be a proper complement and balance to a school devoted to mathematical and logical analysis. Thus in the autumn of 1949, the academic work of the Institute was reorganized to correspond to two schools, a School of Historical Studies

and a School of Mathematics. We have found these themes broad enough to provide a framework for all the undertakings on which we wished to embark.

It is of course manifest that an institute, conceived as ours is, and of such size that its Faculty numbers no more than fifteen or twenty, will not have on that Faculty representatives of all disciplines which could fruitfully be pursued at an institute for advanced study. We have deliberately excluded from our work the sciences that require extensive experimental facilities. Their cost, scope, maintenance and scale are wholly at variance with our budget and practice. Nevertheless occasions arise on which an experimental scientist can and does profit from a year or more of freedom for analysis, criticism and writing in order to get the results of his past work understandable and in form for publication. We have already alluded to the absence at the Institute of adequate facilities for economic and statistical research. Yet economists often can and do find a period at the Institute useful.

There are many fields in which we could well be active, but which happen, for reasons of history or accident, not to be represented on our Faculty. It has been the continuing policy of the Institute, where possible without interference with its other programs, to support such undertakings. Where the Institute's funds are not involved, the Faculty has been glad to vote membership to obviously competent and distinguished men from fields of true scholarship.

From 1948 on, however, we have had, in the form of the Director's Fund, a means of providing grants from Institute funds, grants which would not be directly competitive with the stipend funds of the schools. In this way some twenty men have been brought to the

Institute in the intervening years: in biology, in philosophy, in the history of ideas and literary history and criticism, in law and in contemporary history. Members whose work is supported by the Director's Fund, or by foundations (we have found the foundations, particularly the Ford, Carnegie, Guggenheim and Rockefeller Foundations, most helpful indeed in supporting these undertakings) are elected to membership by the Faculty of the school in which they work. Such members have written, among many others, at least a few books of relatively wide interest and circulation. Examples are Herbert Feis' "The China Tangle"; George Fegnan's "American Diplomacy"; Francis Fergusson's "The Idea of a Theatre". These appointments have served, not only to extend, but to add coherence to, the work of the schools, in particular the School of Historical Studies.

In some cases, we have found it desirable to appoint an advisory committee to consult with us about the qualification of members. This we have done in psychology*. In other fields our own Faculty and those whom we can readily consult provide counsel. The Director's Fund has also made possible a few preliminary conferences--in law, in contemporary history and in psychology, for instance--which were helpful in determining our proper course.

* E. G. Boring, Harvard University; J. S. Bruner, Harvard University; H. S. Langfeld, Princeton University; P. E. Meehl, University of Minnesota; G. A. Miller, Massachusetts Institute of Technology; E. C. Tolman, Berkeley; and R. S. Tolman, Pasadena.

THE COMMUNITY OF SCHOLARS

The varied work of the Institute is, of course, specialized. No advanced study or deep scholarship can be other. We make no attempt--and indeed can make no attempt--to provide formal channels of liaison, or what is unhappily called integration. There have been indeed some instances of unexpected and unpredicited collaboration, as was that between a French Dominican linguist, and a French mathematician, on the theory of languages. We do from time to time sponsor general lectures by our members or Faculty, intended for members and their guests, to give in not too technical terms an account of progress in one or another field: the findings in the Agora, the nature of the electron, the Role of History in Culture.

But it is not in such exceptions, nor by such means, that the essential community of the members of the Institute is to be found. They form a community because many members have in effect a ranging and wide understanding and interest, and some substantial knowledge outside their own field of specialization. They are a community because close friendships contribute to mutual understanding and common interest. The fact that most of the members of the Institute live in the same apartments, eat in the same restaurant, share the same common room and the same library helps to bring them together. The members of the Institute are of course also a part of the larger community of Princeton, with its university and its many institutions of research and learning.

Although the Institute has no administrative or organic connection with Princeton University, there has been very close collaboration in matters of common interest; and we have sought to take advantage

of each other's facilities in the freest possible way. All Institute seminars are attended by interested members of the University's Faculty and Graduate School; and University seminars and conferences are frequently attended by Institute members. There are many cases of collaboration in research between the Institute and the Faculty of the University. Several distinguished members of the Princeton Faculty have elected to spend their sabbatical year or semester in residence at the Institute. We have had for some years a standing inter-faculty committee to consult on problems of common interest. We are, of course, vastly in debt to the University, without which Princeton itself would be both physically and intellectually far less adequate for us as our site.

There have been no radical changes in the Institute's physical plant in the years covered by this report. The Institute has grown, and in response to this growth, we have erected three modest buildings. They have had the triple function (a) of providing study and office space for the increased number of members, (b) of allowing the library to expand from its original confines to adjacent rooms in the main building, Ald Hall, and (c) of providing rooms for consultation, conference and seminars. They have given us about sixty new offices and two new conference rooms, and have been arranged so that continued physical expansion will lead to an open, bell-shaped array of buildings with the opening facing south toward the woods, and Ald Hall at its apex. The cost of these buildings has been about \$4,000,000.

The library itself has grown rapidly, from 24,000 to 40,000 volumes, though we still keep it as a working library, only adding volumes for which professors and members have recurrent and important use, but in no sense attempting completeness even in limited fields.

We still depend decisively on access to the Firestone Library of Princeton University, to whose construction we contributed \$500,000, and without which our problems of adequate access to books would be almost unmanageable. We were fortunate to receive from a Trustee of the Institute, Mr. Lessing Rosenwald, a valuable collection of early editions of scientific texts. This is housed in a separate room of our library, and is much used by historians and scientists alike. To this we are adding in an orderly and modest way. It is the policy of the Institute to support financially when necessary the publication of books and articles communicating the results of the work of its members.

The only other items of addition to plant during these years are two: a shop and garage building for the maintenance and storage for the Institute's equipment and transportation, and a sizeable addition to the building in which the electronic computer is housed, an addition which provides a permanent site for the computer itself, and additional office space for the scientists and coders who make use of the computer for meteorological and other studies, or who are contributing to the improvement and further development of the machine itself. There has been no addition to the housing available to the Institute for its temporary members; and this constitutes a troublesome deficiency in our present plant.

* * * *

The Institute for Advanced Study is devoted to the encouragement, support and patronage of learning--of science, in the old, broad, undifferentiated sense of the word. The Institute partakes of the

character both of a university and of a research institute; but it also differs in significant ways from both. It is unlike a university, for instance, in its small size—its academic membership at any one time numbers only a little over a hundred. It is unlike a university in that it has no formal curriculum, no scheduled courses of instruction, no commitment that all branches of learning be represented in its Faculty and members. It is unlike a research institute in that its purposes are broader, that it supports many separate fields of study, that, with one exception, it maintains no laboratories; and above all in that it welcomes temporary members, whose intellectual development and growth are one of its principal purposes. The Institute, in short, is devoted to learning, in the double sense of the continued education of the individual, and of the intellectual enterprise on which he is embarked.

The report herewith submitted is a brief summary of the measures and activities which, in the period covered by the report, have served to carry out this high purpose.

Robert Oppenheimer

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II
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To —————

In the years from 1948 through 1953, the work of the Institute for Advanced Study has grown, not dramatically, but steadily. Our Faculty has become larger; our annual membership has increased; ~~even more~~; we have added ~~some~~ new buildings. The increase in our expenditures summarizes the quantitative aspects of our growth: In the academic year 1947-48 the Institute spent some \$600,000 of its own money, and \$225,000 of funds contributed by other agencies, principally by departments of the United States Government and by foundations. In the academic year 1952-53 the Institute spent about \$800,000 of its own money; and the contributions of other agencies to our operations had risen to almost \$400,000.

There have been some changes of emphasis as well. There has been a marked increase in our work in theoretical physics, and a very substantial increase in applied mathematics. We have broadened our activities in historical research, and at the same time sought a greater degree of unity in historical studies. We have also embarked on work on some fields hitherto not touched at the Institute, though we remain an institution which, for reasons of design and purpose, or for reasons of limitation of funds, or for reasons of historical accident, works intensively in some fields of science and scholarship and little or not at all in others.

The account which follows will attempt to sketch in broad terms the scope and nature of our scholarly activity, with particular reference to those undertakings that are new, or those changes in emphasis and policy which have evolved in the period covered by the report. In making this report some unevenness is inevitable.

One cannot describe in intelligible lay terms the work of pure mathematicians or theoretical physicists with the same vividness and immediacy with which it is possible to talk of work in applied mathematics or modern history. Thus the attention devoted in this account to the various phases of the Institute's work cannot be a true reflection either of the quantity or of the importance of that work. What we say about abstruse subjects will remain abstruse in summary; what we say of more generally understandable ones, though still brief, may come a little closer to indicating the content ^{and} of the achievement.

~~The academic life of the~~ Institute is composed of two schools, ^a the School of Mathematics and ^a the School of Historical Studies. An account will be given later in this report of the deliberations which led to this arrangement. In each school there is a faculty of senior scholars of eminence, who are appointed until the time of their retirement and who often continue to work as active scholars and members of the Institute ^{long} ~~even~~ after their retirement. The faculty of each school elects the members of the school to terms of membership which may be as short as a semester, which are typically a year or two, and which in rare cases may be for five years or for even longer periods. All faculty appointments and all appointments of long duration ^{require the approval of} ~~are brought before~~ the trustees; but the election of temporary members rests with the faculties, except insofar as policy and budgetary determinations of the trustees may limit the choice. There are some twenty scholars at the Institute who are not members, but who are employed as assistants to professors, or who work as scientists ^{on our projects} in applied mathematics ~~on our projects~~.

SCHOOL OF MATHEMATICS

Pure Mathematics

in the
The ~~place and influence of the~~ School of Mathematics ~~in the~~
~~world of mathematics is evolving rather than static.~~ The School is
~~not a graduate school, a place where a student receives his first~~
~~advanced training and orientation.~~ It is a place where scholars of
all ages, with varying degrees of flexibility and maturity, come to
~~give and to take~~ *each learn* whatever seems to them to be significant. The
exchange is as much between the visiting members as between these
visitors and the professors of mathematics. Some of the most ~~intense~~ *important*
central educational contributions to mathematics occur ~~mathematical exchanges at the Institute today take place in seminars~~
here ~~conducted by members.~~ *There is intense collaboration in research.* Another ~~mode of exchange is found in the writing~~
~~of joint papers.~~ In the last ~~ten~~ years Professor Morse, for example,
has written ~~more than~~ *some* twenty papers in collaboration with visiting
members of the Institute.

The mathematics faculty of the Institute has contributed
its share ~~in~~ *to* the creation of the moving mathematical ideas of our day.
This has been ~~specifically acknowledged~~ *generally recognized, particularly* in the fields of logic,
number theory, information theory, topology, and in the influence
of variational theory on topology. The lectures ~~each fall of our~~ *given by*
~~part-time member,~~ *also* Jean Leray (Professor at the College de France),
have made ~~are making~~ an historic impression in the field of partial differential
equations. Professor Weyl continues his lectures at the Institute
each second term, giving freely of the wealth of his great scholarship.

In bringing young mathematicians here from Europe the
Institute has depended heavily on the knowledge of the European scene

of Professors Weyl and Leray, and of Professor Heins Hopf of the University of Zurich. The results have been most fortunate. ^{More than, distinguished} Mathematicians ~~also~~ elect to come to the Institute on sabbatical leave. ~~Distinguished mathematicians from the Universities of Chicago, California and Cambridge, England, are expected so to come next year.~~ ^{often} In general Institute funds are used to help support these ^{members} ~~Fellows.~~

The Institute is performing another service. Four mathematicians who are now professors of mathematics in major graduate schools first came to the United States from abroad to spend a year of study at the Institute for Advanced Study and thereafter took their present positions. This is an illustration of a significant relation which has been established between the Institute and American universities.

During the period covered by this report there have been some 300 mathematicians who have been members of the Institute. They come to us not only from the United States, but from almost all parts of the free world, from Western Europe, from Latin America ^{Some who have come from abroad} and from Asia. Their work has resulted in the publication of more than 500 papers in the learned journals of mathematics. Their association with the Institute has in many cases greatly broadened the mathematical background of the members and thus helped the progress of mathematical science in the universities and institutes here and abroad from which the members have come, and to which they have returned. ^{A few scholars, coming here from abroad, have accepted chairs in some leading Universities in this country.}

During the last six years five mathematicians have been made professors of mathematics at the Institute for Advanced Study. ~~A brief account of these mathematicians follows.~~

Kurt Gödel, ~~born in Brunn, Czechoslovakia~~, became a permanent member of the Institute for Advanced Study in 1946, and professor in 1953. His achievements in modern logic have been monumental. He was the first rigorously to establish indemonstrability within mathematics proper. His methods in logic are studied wherever logic is studied. Recently he has turned his attention to problems in relativistic cosmology, as well as to logical problems in philosophy, with particular reference to Leibnitz.

Deane Montgomery became a permanent member of the Institute in 1948 and professor in 1951. He had previously been an assistant professor at Smith College and more recently an associate professor at Yale University. His main interest has been in topological groups, including Lie groups, in transformation theory and related fields. His ^{recent} work has been ^{brilliant; it is so} recognized throughout the world and is attracting scholars to the Institute from many lands.

Atle Selberg, ~~born in Norway~~, became a permanent member of the Institute in 1949 and professor in 1951. His earlier studies led him into the congenial mathematical company of Carl Ludwig Siegel. His scientific production, centering in analytic number theory, is deep and extensive. Under his influence, ^{supplemented by} ~~now to be~~ combined with that of Beurling, the Institute ^{to} ~~is~~ ^e ~~becoming~~ a center of study in analytic number theory.

Hassler Whitney rose from the rank of instructor in mathematics at Harvard in 1933 to professor in 1946. He became professor at the Institute in 1952. His interest has been mainly in topology and its applications to differential manifolds. He is fundamentally a pioneer with profuse and fruitful ideas. Recently

he has been led to a theory of r -dimensional integration.

Arne Beurling came to the Institute as a member in 1951, and has just been appointed professor of mathematics. From 1937 to 1951 he was professor of mathematics at Uppsala. He had established himself as one of the great leaders in modern mathematics long before he came here. He has originated some of the most fertile ideas ^{about} ~~in~~ conformal mapping, harmonic analysis and analytic number theory. His presence here gives additional breadth and unity to the mathematical influence of the Institute.

Theoretical Physics

In the years 1948 to 1953, there has been a marked growth in the work of the Institute in theoretical physics. This was a natural development for the Director to undertake. It has been supported throughout by faculty and trustees. The Institute has always had a few members interested in theoretical physics, ~~this~~ was inevitable in a school of which Einstein was a first member, and which Pauli and Bohr visited from time to time. But both the scope and the character of the work have changed. We have appointed two professors, Freeman Dyson and Abraham Pais; we have made arrangements for a continuing or recurrent association with the Institute for a number of physicists: Ni^{ls} Bohr, P. A. M. Dirac, Res Jost, G. Placzek, W. Pauli, L. Van Hove and C. N. Yang. The number of annual members has increased rapidly; in 1953, we had about 25 men in this field working at the Institute; and in the whole period, we have had about a hundred such members. Their work has eventuated in the publication

of between one and two hundred papers in the Physical Review and, to a more limited extent—in other technical journals.

The members in physics come to us from many places, and in many different stages of their work. A few of the most brilliant post-doctoral students in the country come here for a year or two of further study; a few come to us on leave from assignments involving serious administrative duties with the government or with industrial laboratories, and have an opportunity both to complete work which they have wished to undertake, and to learn of the new things that are under development. Many are scientists from abroad. In fact, it was in physics that we first reestablished effective and continuing contact with the Japanese scientists. We have had ^{a few} ~~extremely~~ brilliant young Chinese, who have immigrated from China after the war. Members come from India and Pakistan, and from almost every country of Western Europe. Very often members in physics, as in other subjects, have the support of their own governments, or ^{of} an agency of the United States Government, such as the National Science Foundation, or of fellowships given by American universities or foundations.

The work in physics is coherent, but not organized. There are seminars of two kinds: one is a continuing seminar, meeting ^{high} weekly or biweekly whenever the Institute is in session, on problems of current interest, on the work of members, or, ~~more rarely~~, on work done elsewhere which we need to hear and discuss at first hand. The other seminars are devoted to a ^{single} theme, usually one which is in need of critical review and analysis, and may continue for a month or a semester or more. Examples are superconductivity, semiconductority, group theory of nuclear energy levels, and the solubility of the equations of quantum field theories.

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Among physicists permanently associated with the Institute, it is appropriate to mention a few examples of achievement. Dyson has made searching analyses of the mathematical consistency and meaning of the fundamental theories of matter. It was he who first showed in what sense the quantum theory of electrons and electromagnetic radiation could be interpreted in a mathematically coherent way to explain a vast range of physical phenomena. He has initiated searching enquiries as to the ultimate consistency of the theory of nuclear forces and made important advances in the application of this theory to the most recent experimental findings.

Pais has for many years devoted himself, among other things, to the problem of the nature and structure of the elementary particles of physics. Some of his major contributions have been critical and negative, in showing that earlier suggestions describing the structure in space and time of primordial problems were neither logically consistent, nor in agreement with experience. His most recent efforts have been devoted to a new description of the structure of matter, which at best is only a first step in the solution of this great problem, but which does throw some light on the true properties of these objects as they are observed in nature. It is probable that a real solution or even a major advance in the description of elementary particles and their interaction is a task which will take years for its accomplishment, years of mathematical improvisation on the one hand, and of analysis and synthesis of experimental findings on the other.

Placzek has continued brilliant, critical, and highly successful studies of scattering phenomena, particularly where they

are determined by the properties of matter in bulk, of crystals and liquids. He has brought order and enlightenment to many of the darkest corners of this field.

Yang's work has touched on so many themes and with such success that a summary is inadequate. His contributions range from the theory of elementary particles and their stability, to the problems of order and disorder, ferromagnetism, and to the theory of condensation and of changes of state.

The principal subjects of work in theoretical physics at the Institute have had to do with the structure, nature, interactions, description and theory of the primordial particles of which matter is composed. But there has been much work of a methodological nature, especially in quantum electrodynamics and in the so-called meson theory of nuclear forces. There has been work on classical nuclear physics, on statistical mechanics, on problems of order and disorder, condensation, the solid state and the strange phenomena of superconductivity and superfluid helium. In a few cases there has been extraordinarily fruitful collaboration between theoretical physics and pure mathematics; and among many members there is a substantial community of interest and knowledge between these two disciplines.

Applied Mathematics - The Electronic Computer

In 1946 John von Neumann had organized a group to develop and construct at the Institute a large-scale, high-speed electronic computing instrument which could be used as a new tool for the

mathematician. In view of the difficulties that beset researchers in the field of non-linear mathematics for the last half century, an electronic machine of suitable size and speed may be used toward gaining those heuristic insights which are the first steps in the direction of an exploration of a field. With the goal of obtaining a machine with adequate characteristics, the group undertook an engineering research and development program which culminated in January, 1952 with the completion of a machine. This machine was the prototype for a number built by various government agencies. It has also contributed ideas to a number of other groups which have produced comparable instruments.

Concurrent with the engineering program, another small group studied the logical problems connected with the design of the machine and the final instrument reflects the interplay between the two groups.

As a continuing effort, some mathematicians have been working with von Neumann to develop those numerical techniques required by the particular characteristics of the new machines. They also make extensive use of the machine to test out these techniques. A variety of problems has been run, including some of interest to the pure mathematician, as well as a considerable number of interest to the applied mathematician. These include number theoretical, hydrodynamical and astrophysical problems, as well as the meteorological work described below.

Since the completion of the machine, the major emphasis of the entire project has shifted to operation of the machine and to further improvements of its organization and components. These

activities are proceeding in a cooperatively fruitful fashion.

The Institute has been fortunate in being supported in these activities by a number of government agencies that have a great interest in computational problems. Its major efforts, the machine construction and operation programs, are supported by the Ordnance Corps, U. S. Army; the Office of Naval Research, U. S. Navy; the Air Research and Development Command, U. S. Air Force; and the Atomic Energy Commission under contracts with the Ordnance Corps. The Institute has each year made substantial financial contributions to this program. The mathematical work has been sponsored by the Office of Naval Research, U. S. Navy, since 1947.

The ~~entire~~ planning and construction program has been made possible by the joint efforts of Julian H. Bigelow, Herman H. Goldstine, James H. Pomerene and John von Neumann, together with a staff of electrical engineers.

Applied Mathematics - The Meteorology Project

The Meteorology Project was established concomitantly with the Electronic Computer Project in 1946, with the expectation that the computer would be a powerful research tool in the investigation of fundamental problems in dynamical meteorology, and would make possible for the first time a direct attack on the problem of weather prediction by numerical solution of the hydrodynamical and thermodynamical equations governing the motion of the atmosphere.

It was decided in 1948 that the complex of mathematical and physical problems of numerical prediction could best be solved by

studying in turn each of a sequence of successively improving idealized mathematical models of the atmosphere. Despite the very simplified character of the first models, results of considerable theoretical and some practical interest were obtained as early as 1949. The first attempt to use an electronic computer for numerical prediction was made in 1950 on the Eniac, an instrument made available by the Ballistic Research Laboratories of the Aberdeen Proving Ground. The results were encouraging and led to the construction of models of greater complexity for use with the Institute computer. After its completion in January, 1952 the Institute computer was used extensively for a series of numerical experiments which culminated in early 1953 with the development of a model by means of which one was able to solve the problem of the prediction of storm generation (cyclogenesis), the chief obstacle that had stood in the way of accurate weather prediction. With respect to this, our crucial experiment was the correct calculation of the great Appalachian storm of November 25, 1950. Similar success was also obtained in the two subsequent calculations of this type that were undertaken: Those of the storms of November 12, 1952 and of November 5, 1953, both in the eastern United States. At this stage there was no longer any doubt that these numerical methods were more accurate than all existing, standard methods. Therefore, the civil and military weather services of the United States government decided in late 1953 to organize a Joint Numerical Weather Prediction Unit in Washington, D. C. to put into practical operation the methods developed by the Project.

Concurrently with the short-range prediction studies, a series of investigations were made of the factors governing the

long-range evolution of weather. These studies are essentially attempts to understand what produces the circumpolar band of strong westerly winds at middle latitudes and their quasi-stationary mean perturbations. It was demonstrated, that the traveling low- and high-pressure systems (cyclones and anticyclones) act as turbulent eddies transferring the potential energy derived from solar radiation into the kinetic energy of the mean westerly winds, and thus maintaining them against frictional dissipation. The study of the effects on the mean air flow of friction, heating, and continental obstacles led to a theory which is in encouraging agreement with the observed perturbations of the westerlies.

The work of the project has stimulated meteorologists elsewhere toward similar efforts in numerical meteorology. There are now active centers of academic research in this field in England, Norway, Sweden, Denmark, Western Germany and Japan.

The project was supported financially originally by the Office of Naval Research, and since 1951 jointly by the Office of Naval Research and the Geophysics Research Division of the Air Force Cambridge Research Center. It has had the good fortune to secure the collaboration of visitors of outstanding ability from the Universities of Chicago, Oslo, Stockholm, Copenhagen, London and Tokyo, and from the United States Weather Bureau.

The Meteorology Project has been under the immediate direction of Charney and von Neumann. Important contributions were made to its work by N. Phillips and several temporary members, of whom A. Eliassen (~~University of Oslo~~), R. Fjørtoft (~~University of Copenhagen~~) and J. Smagorinsky (U. S. Weather Bureau) should be particularly

mentioned. The advice of C. A. G. Rossby, now at Stockholm,
generously given throughout the years, has been most valuable.
The work of the Institute in applied mathematics has received
valuable support by a gift of the International Business Machines
Company of \$20,000 ^{a year} for five years, since 1949.

SCHOOL OF HISTORICAL STUDIES

There is no work in the School of Historical Studies as extensive—and at the same time concentrated and coherent—as that in pure mathematics or in theoretical physics. We do not in any sense "cover" historical studies, as we do try to cover pure mathematics. What we have sought is to encourage work in areas of historical research which are manifestly fruitful, and in which a very high level of scholarly excellence, intellectual interest and fundamental historical discovery are assured.

Archaeology

↓ The scholarly resources of the Institute play a ^{growing} vigorous part over a wide range in the fields of Greek Archaeology and History. The library, ^{as it becomes} becoming increasingly adequate and useful, the files, records and pictures of current excavations, and the opportunities offered to scholars from abroad have all made this a centre for work in the classical fields. The results of research initiated in other institutions, and new material from current excavations are gathered, assimilated, subjected to comment and criticism and presented through publications to both scholarly and lay audiences. The fruition of such cooperation and collaboration is proving to be far richer than the work of an isolated scholar.

This work has not been limited to any single period. In the field of Prehistory, Professor Goldman and her collaborators have been studying and publishing the valuable results of the excavations at Tarsus in Asia Minor. Professor Wace, formerly of Cambridge,

during the past few years has been illuminating, by his excavations at Mycenae, which he studies and publishes here, the earliest stages of Greek civilization. In the general field of Greek history work has recently been done on the early history of Greece, on Ionia, on papyrological problems, and on the calendar. Publications by the American School of Classical Studies at Athens, whose headquarters are maintained at the Institute, have included works on excavations, on mediaeval castles and on early travelers in the Levant.

Attention is being given particularly to the publication of recent discoveries in Greece, especially those at Corinth and Athens. Members of the School of Historical Studies who come to work with Professor Meritt or Professor Thompson have assisted in evaluating this new material. Many of these have come from Oxford and Cambridge, others from the Greek Archaeological Service, and a goodly number from France, Holland and other parts of Europe.

One large field of study which occupies many members is the history of the ancient city of Athens. The records of the Agora Excavations of the American School of Classical Studies, of which duplicates are now housed here, provides a wealth of material on all subjects. Professor Meritt and his associates have concentrated on the epigraphical documents, of which they have a unique collection of copies. These they have used as a basis for the study of the Athenian tribute lists and thus put on a sound basis that important field in the history of fifth century Athens. They are also studying the statistics and personnel of the Athenian population. Since the new documents from Athens alone amount to some 6700 items, the possibilities inherent in the publication of this body of material are very great. The political, financial, and military history of

Athens is therefore continuously under reexamination by the various members from year to year.

Professor Thompson and his associates devote themselves chiefly to the study for publication of the other material from the Agora Excavations. Professor Thompson directs not only the field work in Athens, for which he is given leave of absence by the Institute, but he organizes and supervises the publications. With the collaboration of a number of members, he is directing the study of ceramics, sculpture, numismatics, literary testimonials, and various minor arts. He himself makes the topography and architecture his especial interest. He also endeavors to make all aspects of these studies available to the layman, by giving illustrated lectures and by writing for more popular journals. In this way, the results of scientific investigation are brought to bear upon the work of scholars and upon the thought of the people of today.

In the period covered by this report, some forty members have worked at the Institute on archaeological problems.

Greek Philosophy and Science

Knowledge of the ancient Mediterranean world and especially of ancient Greece is significant and important not only because modern European or Western civilization is a lineal descendant of the Greek but also because the development of Western thought and institutions even during the Middle Ages, and especially since the Renaissance, has repeatedly been inspired and influenced anew by direct contact with the literary and artistic monuments of that ancestral civilization. Greek philosophy and science, in the broad ancient sense of these

terms, are the integrating factor of that ancient civilization itself and of its flowering in Western civilization. In 1948 it was decided to make provision for these studies and so to supplement the work in Greek history, archaeology, and epigraphy already being intensively pursued here; for this purpose Professor Cherniss was appointed. From 1949 onward an increasing number of scholars working on special problems in ancient philosophy and science have come on annual appointments to the Institute from various universities in this country and in Europe and have worked in consultation with Cherniss and in occasional, informal seminars.

Besides the work done by Cherniss and in consultation with him on Plato, Aristotle, and the ancient interpretations and developments of their philosophical and scientific thought, special studies have been made of the sources for the history of ancient philosophy. This is a subject complicated by problems of text and interpretation and in many cases requires at the outset new editions. Some of our members have devoted their time to the preparation of such critical editions of Diogenes Laertius, the fragments of Theophrastus, and the philosophical and scientific essays of Plutarch. Others have concerned themselves more especially with the transmission of Greek philosophy and science through the two main intermediary literatures, Arabic and Latin. Thus the tradition of Greek thought has been studied on its way to mediaeval Europe by the indirect as well as by the direct route.

Ancient Astronomy

Certain aspects of the Mediterranean scientific activity that antedate the Greek, and of the influence and counter-influence

of ancient Greek and non-Greek science, have also been intensively studied. Professor Neugebauer, who was a member of the Institute several times before 1948 and who since 1948 has been in residence regularly for one term out of every four, has worked with other members on Greek, Muslim, and Hindu astronomy ^{+ mathematics,} has collaborated with another member in the publication of a book on the Greek calendar, and has recently completed his monumental corpus of Astronomical Cuneiform texts. A popular account of Neugebauer's brilliant work has been published by him in "The Exact Sciences in Antiquity".

Palaeography

Meanwhile the technical aspect of Latin literary transmission continues to be studied. Professor Lowe, though he has been emeritus for some years, has steadily proceeded with the publication of his definitive work on Latin palaeography, the Codices Latini Antiquiores, the sixth volume of which appeared in 1953. Other members have worked with Lowe on special problems in Latin palaeography or have themselves applied the principles of this science, which he has done so much to advance, to the edition of mediaeval Latin texts. Lowe's intensive and fruitful work well illustrates how little in fact retirement from the Institute's faculty terminates or disrupts a scholar's professional life.

Mediaeval History

Mediaeval History, for the first time permanently represented through the appointment of Professor Kantorowicz in 1951, has during

the last ~~six~~ years been the field of interest of ~~at least~~ nine temporary members besides those engaged in mediaeval art and musicology.

~~Intellectual history~~ — The great problem of transition from Late Antiquity to the Christian Age as well as that of the continuity of the classical tradition in both Byzantium and the West has naturally attracted the attention of several members. A major work on the notions Reformation, Renovation, Renaissance has been begun at the Institute and has yielded a number of preliminary studies in which the patristic background of those notions has been disclosed. Two studies on Image Worship and the ensuing Iconoclast Controversy in Byzantium were published in connection with the edition of source material relevant to that problem. Imagery was a matter of politics, and its political character has led to studies on the Ruler Image in late antique and Carolingian times. While the continuity of the antique Ruler Cult in Christian guise formed the subject of several studies, Mediaeval Learning has not been neglected: some of the leading Theologians and Scholars of the Carolingian period have been studied by a temporary member, and another scholar devoted his time at the Institute to the study of the literary and pictorial sources of Students' Life at mediaeval universities.

~~Political history~~ — Mediaeval studies have their peculiar difficulties. The advantages of classical scholarship with its long tradition of text^{ual} criticism, its highly developed and well organized apparatus of auxiliaries and its relatively ^{limited} ~~controllable~~ amount of literary sources are not ^{available to} ~~those of~~ the mediaevalist; nor can ^{he} ~~the~~ mediaeval historian approach his subject ~~straightforwardly~~ from a ^{limited} ~~chiefly~~ political or diplomatic point of view, as would seem justified

in the case of the modern historian. Interposed ^P problems of religion and dogma conditioned that period in its entirety, and there is little hope ^{to} ~~to~~ understand ^{the} ~~the~~ complexity of mediaeval political problems without the concurrent study of theology, liturgy, scholastic philosophy, or canon and civil laws with their glosses, ~~branches of knowledge from which modern mind has been moving away, ever since the 17th century, so rapidly that their specific value for political history, obscured by a long tradition, cannot easily be recovered.~~ Legal and theological sources, however, have yielded a considerable amount of new information for a number of studies devoted to Constitutional History, and have been of major importance for a book on mediaeval Political Theory, or Political Theology, which is nearing its completion.

~~Text editions~~ -- Intellectual history and the history of political ideas, however, did not monopolize mediaeval historical studies. In addition to the evaluation of literary texts, which an eminent European scholar could continue at the Institute, and studies on Chaucerian England, the Texts themselves called for ^{scholarly editing.} ~~students.~~ Texts, badly edited or not edited at all, must be made accessible by means of critical editions, and this ~~Philological~~ ^{scholarly editing.} work remains an important task of the mediaeval historian, whose work in this respect is akin to that of the classical scholar rather than of the modern historian. A new, and perhaps the final, edition of Geoffrey of Monmouth's fabulous, if influential, "History of the Kings of Britain" has been published with the support of the Institute. A source related to the times of the Investiture Struggle occupies a temporary member, while another visitor is engaged in the edition of some hitherto poorly known Political Writings of the later Middle Ages.

There is no lack of variety in mediaeval studies, and the ~~Institute's~~ ^{has proven ... not to be a good place for them.} stimulus cannot easily be underestimated. For in all those endeavors the exchange of ideas and material with other members engaged in the study of Paleography, Mediaeval Art and Music, or in that of Near Eastern--Iranian and Arabian--Philosophy has proved to be invaluable.

History of Art

During the last six years the group of scholars exclusively or preponderantly engaged in art historical studies included, in addition to the two permanent members (Professors Panofsky and Weitzmann), fifteen temporary members, among them leading art historians from France, West Germany, Holland, and Sweden.

Since works of art reflect cultural situations in all their aspects, the research of this group was varied and strongly individualized in subject matter and scope. ~~No formal "projects" or "programs" were launched, and there was no limitation as to media.~~ While considerable emphasis was placed on factual problems solvable by means of archaeological investigation, stylistic analysis, and iconographic interpretation, no less attention was paid to the study of the interplay between art and literature, theology, philosophy and science; in this respect the peculiar character of the Institute, favorable to the cooperation of scholars and scientists active in widely different fields, proved to be of inestimable advantage. On the other hand, the work of the individual members, for all its independence, frequently overlapped or interpenetrated owing to an affinity of subject matter,

and was always unified by personal contact and a community of methodical convictions. We have tried to avoid the danger of dilution and over-expansion by subjecting our work to the requirements of a strictly historical discipline and by restricting it to the spatial limits of the Roman Empire and the temporal limits of the periods known as the Middle Ages, the Renaissance, and the Baroque.

The work of the group encompassed mediaeval architecture (including its relation to contemporary thought and its evaluation in later centuries), book illumination, sculpture, glass painting, and what our own age somewhat unfairly refers to as "the minor arts"; Early Christian and Byzantine painting and book illumination; Northern painting and book illumination in the 15th and 16th centuries; Rembrandt and his Netherlandish contemporaries. On the other hand, intensive study was devoted to such more general problems as classical survivals and revivals in post-classical art and literature and the changing theological and philosophical attitudes towards the visual arts. In the last two years a successful attempt was made to bring the music of the Middle Ages, the Renaissance and the Baroque into the orbit of art historical studies.

A great number of art historical books and articles published between 1948 and 1953 resulted, wholly or to an essential part, from the authors' activities at the Institute. Mention may be made of three important books on Early Christian and Byzantine painting and book illumination by Professor Weitzmann (Princeton, 1947, 1948, 1951); Dr. de Tolnay's Michelangelo (Paris, 1951); of Professor George H. Forsyth's monumental monograph, The Church of St. Martin at Angers (Princeton, 1953); and, of Professor Panofsky's Early Netherlandish Painting; Its Origins and Character (Cambridge, 1953, developed from the Charles Eliot Norton Lectures delivered at Harvard University in 1947/1948)

Modern History

The work in modern history has prospered. It has been strengthened by the election to the faculty of Sir Llewellyn Woodward, and by the continuing and recurrent memberships, among others, of the distinguished British historian, C. Veronica Wedgwood, and the French Geographer, Jean Gottman. Professor Earle has continued with his well-known seminar method which he developed in the early days at Columbia. ^{He has conducted} ~~There have been~~ seminars on the Dynamics of Soviet Policy, on the Causes of American Entry into the First World War, on the Decline of Liberalism as a Political Philosophy, and on Modern France. The scholars who have come to attend these seminars have of course in the first instance continued the researches ^{on the first hand} ~~which were of interest~~ ^{engaged} ~~to them~~. The seminars have served to stimulate, to correct and to collate. There have been some forty members during these years in the field of modern history, including a few ^{who} like Kennan and Feis, ~~who~~ have first come as stipendiates under the Director's fund, as ~~will~~ be described below. These memberships have led directly to the publication of some twenty volumes and have contributed to the publication of some ^{others.} ~~twenty/volumes and have contributed to the publication of some~~ ~~twenty others.~~

Since his election to membership of the Institute, Sir Llewellyn Woodward (who was previously Professor of Modern History in the University of Oxford) has been working on a "History of England from 1906 to 1926". He has chosen this period because it covers the years immediately before and after the First World War, and thus provides an opportunity of estimating how far this war accelerated or retarded political, social, and economic developments in Great Britain. Sir Llewellyn Woodward's history will comprise three or four volumes,

of which one volume is practically complete.

Sir Llewellyn Woodward is also editing (with Mr. Rohan Butler of All Souls College, Oxford), at the invitation of the British Foreign Office, a series of volumes of "Documents on British Foreign Policy, 1919-39". Six of these volumes—dealing with British policy in Europe in 1938-9—have appeared since Sir Llewellyn Woodward's membership of the Institute. Other volumes are in course of publication. Owing to the nature of the material this editorial work has to be done mainly in the archives of the British Foreign Office, and for this purpose Sir Llewellyn Woodward has visited England each year during the long vacation of the Institute.

THE SCHOOLS AND THE DIRECTOR'S FUND

Until 1948, the academic life of the Institute was divided into three schools: a large and growing School of Mathematics, which included applied mathematics and physics and was to include more and more of them; a relatively small School of Humanistic Studies, concerned with, but not confined to classical archaeology, paleography and the history of art; and a School of Economics and Politics, with three professors of economics and one of modern history. Circumstances were soon to change. Professor Riefler resigned to reenter the Federal Reserve System; Professor Warren died; and Professor Stewart retired, and now serves on the President's Council of Economic Advisers. But even before these ^{events} ~~evidences~~ had changed the complexion of the faculty, we had had serious consideration of the proper direction of the work of the Institute in fields other than mathematics and physics. We were led to doubt whether the Institute, limited in facilities for statistical and economic research, divorced from students and from current affairs, was a likely site for systematic, continuing advanced work in economics. It obviously is and has remained a desirable place for many economic studies of limited extent, and for economic history.

We further became convinced that the unifying and invigorating element of work in history and the humanities must be the conscious and scrupulous use of the historical method; and that a school devoted to this purpose would, for all its heterogeneity, be a proper complement and balance to ~~the~~ school devoted to mathematical and logical analysis. Thus in the autumn of 1949, the academic work of the Institute was

reorganized to correspond to two schools, a School of Historical Studies and a School of Mathematics. We have found these themes broad enough to provide a framework for all the undertakings on which we wished to embark.

no gap

Director's Fund

It is of course manifest that an institute, conceived as ours is, and of such size that its faculty numbers no more than fifteen or twenty, will not have on that faculty representatives of all disciplines which could fruitfully be pursued at an institute for advanced study.

We have deliberately excluded from our work the sciences that require extensive experimental facilities. Their cost, scope, maintenance and ^{scale}~~skill~~ are wholly at variance with our budget and practice.

Nevertheless occasions arise on which an experimental scientist can and does profit from a year or more of freedom for analysis, criticism and writing in order to get the results of his past work understandable and in form for publication. We have already alluded to the absence at the Institute of adequate facilities for economic and statistical research. Yet economists often can and do find a period at the Institute useful.

There are many fields in which we could well be active, but which happen, for reasons of history or accident, not to be represented on our faculty. It has been the continuing policy of the Institute, where possible without interference with its other programs, to support such undertakings. Where the Institute's funds are not involved, the faculty has been glad to vote membership to obviously competent and distinguished men from fields of true scholarship.

From 1948 on, however, we have had, in the form of the Director's Fund, a means of providing grants from Institute funds, grants which would not be directly competitive with the stipend funds of the schools. In this way some twenty men have been brought to the Institute in the intervening years: in biology, in philosophy, in the history of ideas and literary history and criticism, in law and in contemporary history. Members whose work is supported by the Director's Fund, or by foundations (we have found the foundations, particularly the ^{Carnegie, Guggenheim} Ford, and Rockefeller Foundations, most helpful indeed in supporting these undertakings; ~~and it is our determination to continue them~~), are nevertheless elected to membership by the faculty of the school in which they work. Such members have written, among many others, at least a few books of relatively wide interest and circulation. Examples are Herbert Feis' "The China Tangle"; George Kennan's "American Diplomacy"; Francis Fergusson's "The Idea of a Theatre". These appointments have served, not only to extend, but to add coherence to, the work of the Schools, in particular the School of Historical Studies.

In some cases, we have found it desirable to appoint an advisory committee to consult with us about the qualification of members. This we have done in psychology*. In other fields our own ²⁰⁴ faculty and those whom we can readily consult provide counsel.

* E. G. Boring, Harvard; J. S. Bruner, Harvard; H. S. Langfeld, Princeton; P. E. Meehl, Minnesota; G. A. Miller, MIT; E. C. Tolman, Berkeley; R. S. Tolman, Pasadena.

The Director's Fund has also made possible a few preliminary conferences--in law, in contemporary history and in psychology, for instance--which were helpful in determining our proper course.

THE COMMUNITY OF SCHOLARS

The varied work of the Institute is, of course, specialized. No advanced study or deep scholarship can be other. We make no attempt—and indeed can make no attempt—to provide formal channels of liaison, or what is unhappily called integration. There have been indeed some instances of unexpected and unpredicted collaboration, as was that between a French Dominican linguist, and a French mathematician, on the theory of languages. We do from time to time sponsor general lectures, ^{by our members or faculty,} intended for members and their guests, to give in not too technical terms an account of progress in one or another field: ^{The friendship in the area, the nature of the election, the Role of History in Culture.} But it is not in such exceptions, nor by such means, that the essential community of the members of the Institute is to be found. They form a community because many members have in effect a ranging and wide understanding and interest, and some substantial knowledge outside their own field of specialization. They are a community because close friendships contribute to mutual understanding and common interest. The fact that most of the members of the Institute live in the same apartments, eat in the same restaurant, share the same common room and the same library helps to bring them together. The members of the Institute are of course also a part of the larger community of Princeton, with its university and its many institutions of research and learning.

no gap

RELATIONS WITH PRINCETON UNIVERSITY

Although the Institute has no administrative or organic connection with Princeton University, there has been very close collaboration in matters of common interest; and we have sought to take advantage of each other's facilities in the freest possible way. All Institute seminars are attended by interested members of the University's faculty and Graduate School; and University seminars and conferences are frequently attended by Institute members. There are many cases of collaboration in research between the Institute and the faculty of the University. Several distinguished members of the Princeton faculty have elected to spend their sabbatical year or semester in residence at the Institute. We have had for some years a standing inter-faculty committee to consult on problems of common interest. We are, of course, vastly in debt to the University, without which Princeton itself would be both physically and intellectually far less adequate for ^{us as an} ~~our own~~ ^{size.} undertakings.

~~PLANT~~

no gap

There have been no radical changes in the Institute's physical plant in the years covered by this report. The Institute has grown, and in response to this growth, we have erected three modest buildings. They have had the triple function (a) of providing study and office space for the increased number of members, (b) of allowing the library to expand from its original confines to adjacent rooms in the main building, Fuld Hall, and (c) of providing rooms for consultation, conference and seminars. They have given us about sixty new offices and two new conference rooms, and have been arranged so that continued physical expansion will lead to an open, bell-shaped array of buildings with the opening facing south toward the woods, and Fuld Hall at its apex. The cost of these buildings has been about \$400,000. [The library itself has grown rapidly, from 24,000 to 40,000 volumes, though we still keep it as a working library, only adding volumes for which professors and members have recurrent and important use, but in no sense attempting completeness even in limited fields. We still depend decisively on access to the Firestone Library of Princeton University, to whose construction we contributed ^{\$500,000} half a million dollars, and without which our problems of adequate access to books would be almost unmanageable. We were fortunate to receive from a trustee of the Institute, Mr. Lessing Rosenwald, a valuable collection of early editions of scientific texts. This is housed in a separate room of the library, and is much used by historians and scientists alike. To this we are adding in an orderly and modest way.

It is the policy of the Institute to support financially when necessary the publication of books and articles communicating the results of the work of its members.

The only other items of addition to plant during these years are two: a shop and garage building for the maintenance and storage for the Institute's equipment and transportation, and a sizeable addition to the building in which the electronic computer is housed, an addition which provides a permanent site for the computer itself, and additional office space for the scientists and coders who make use of the computer for meteorological and other studies, or who are contributing to the improvement and further development of the machine itself. There has been no addition to the housing available to the Institute for its ~~contemporary~~ members; and this constitutes a troublesome deficiency in our present plant.

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gap

The Institute for Advanced Study is devoted to the encouragement, support and patronage of learning--of science, in the old, broad, undifferentiated sense of the word. The Institute partakes of the character both of a university and of a research institute; but it also differs in significant ways from both. It is unlike a university, for instance, in its small size--its academic membership at any one time numbers only a little over a hundred. It is unlike a university in that it has no formal curriculum, no scheduled courses of instruction, no commitment that all branches of learning be represented in its faculty and members. It is unlike a research institute in that its purposes are broader, that it supports many separate fields of study, that, with one exception, it maintains no laboratories; and above all in that it welcomes temporary members, whose intellectual development and growth are one of its principal purposes. The Institute, in short, is devoted to learning, in the double sense of the continued education of the individual, and of the intellectual enterprise on which he is embarked.

The report herewith ~~respectfully~~ submitted is a brief summary of the measures and activities which, in the period covered by the report, have served to carry out this high purpose.

PROFESSORS

School of Historical Studies

Harold F. Cherniss
Edward Mead Earle
Ernst H. Kantorowicz
Benjamin D. Meritt
Erwin Panofsky
Homer A. Thompson
E. L. Woodward

School of Mathematics

Arne Beurling
Freeman J. Dyson
Kurt Godel
Deane Montgomery
Marston Morse
Robert Oppenheimer
Abraham Pais
Atle Selberg
John von Neumann
Hassler Whitney

MEMBERS WITH APPOINTMENTS OF LONG TERM

School of Historical Studies

Sir Henry Clay
Paul Frankl
Hetty Goldman**
Jean Gottman
George Kennan
E. A. Lowe**
David Mitrany
Otto Neugebauer
~~George Stamires~~
Walter W. Stewart**
Jacob Viner
C. Veronica Wedgwood
Kurt Weitzmann

School of Mathematics

James W. Alexander
Julian H. Bigelow
Niels Bohr
Jule G. Charney
~~Freeman J. Dyson~~
Albert Einstein**
Herman H. Goldstine
Res Jost
Jean Leray
Otto Neugebauer
Wolfgang Pauli
George Placzek
Leon C. Van Hove
Oswald Veblen**
Hermann Weyl**
Chen Ning Yang

~~* Director~~

** Professors Emeriti

THE INSTITUTE FOR ADVANCED STUDY

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125 Park Avenue
New York 17, New York

Wilmarth S. Lewis
Farmington
Connecticut

Harold F. Linder
Room 4708
40 Wall Street
New York 5, New York

Herbert H. Maass
20 Exchange Place
New York 5, New York

Sydney A. Mitchell
184 East 64th Street
New York, New York

Lessing J. Rosenwald
Jenkintown and Meeting House Roads
Jenkintown, Pennsylvania

Michael Schaap
Bloomingdale's
Lexington Avenue at 59th Street
New York 22, New York

Lewis L. Strauss
Room 5600
30 Rockefeller Plaza
New York 20, New York

February 8, 1954

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draft I
3/6/54

Introduction

In the years from 1948 through 1953, the work of the Institute for Advanced Study has grown ^{but} steadily, but not dramatically. Our Faculty has become larger; our annual membership has increased even more; we have added some new buildings, and the increase in our expenditures summarizes the quantitative aspects of our growth. In the academic year 1947-48 the Institute spent some \$600,000 of its own money, and \$225,000 of funds contributed by other agencies, principally ^{by} departments of the United States government and foundations. In the academic year 1952-53 the Institute spent about \$800,000 of its own money; and the contributions of other agencies to our operations had risen to almost \$400,000.

There have been some changes of emphasis as well. There has been a marked increase in our work in theoretical physics, and a very substantial increase in applied mathematics. We have broadened our activities in historical research, and at the same time sought a greater degree of unity in historical studies. We have also embarked on work in some fields hitherto not touched at the Institute, though we remain an institution which, for reasons of design and purpose, or for reasons of limitation of funds, or for reasons of historical accident, works intensively in some fields of science and scholarship and little or not at all in others. The account which follows will attempt to sketch in broad terms the scope and nature of our scholarly activity, with particular reference to those undertakings that are new, or those changes in emphasis and policy which have evolved in the period covered by the report. In making this report some unevenness is inevitable.

One cannot describe in intelligible lay terms the work of pure mathematicians or theoretical physicists with the same vividness and immediacy with which it is possible to talk of work in applied mathematics or modern history. Thus the attention devoted in this account to the various phases of the Institute's work cannot be a true reflection either of the quantity or of the importance of that work. What we say about abstruse subjects will remain abstruse in summary; what we say of more generally understandable ones, though still brief, may come a little closer to indicating the content of the achievement.

The academic work life of those is confused
~~The work of the Institute takes place in~~ two schools, the School of Mathematics and the School of Historical Studies. An account will be given later in this report of the deliberations which led to this ~~arrangement~~ *policy*. In each school there is a faculty of senior scholars of ~~great~~ eminence, who are appointed until the time of their retirement and who often continue to work as active scholars and members of the Institute even after their retirement. The faculty of each school elects the members of the school to terms of membership which may be as short as a semester, which are typically a year or two, and which in rare cases may be for five years or for even longer periods. All faculty appointments and all appointments of long duration are brought before the trustees; but the election of temporary members rests with the faculties, except insofar as policy and budgetary determinations of the trustees may limit the choice. There are ~~a few~~ *some twenty* scholars at the Institute who are not members, ~~but who come as~~ *are employed as* assistants to ~~the~~ professors, or who work ~~in applied~~ *as assistants to* mathematics, ~~as scientists employed from year to year by our projects in~~ *on* ~~this field.~~ *in applied mathematics*

SCHOOL OF MATHEMATICS

Pure Mathematics

(Morse)

*The professors of mathematics should criticize this
Morse.*

~~INSTITUTE FOR ADVANCED STUDY~~
School of Mathematics

During the last six years five mathematicians have been made Professors of Mathematics at the Institute for Advanced Study. A brief account of these mathematicians follows.

Kurt Gödel, born in Brunn, Czechoslovakia, became a permanent member of the Institute for Advanced Study in 1946, and professor in 1953. His achievements in modern logic have been monumental. He was the first to rigorously establish indemonstrability within mathematics proper. His methods in logic are studied wherever logic is studied. Recently he has turned his attention to problems in ^{relativity} cosmology, as well as to problems in philosophy, with particular reference to Leibnitz.

Deane Montgomery became a permanent member of the Institute for Advanced Study in 1948 and professor in 1951. He had previously been an assistant professor at Smith College and more recently an associate professor at Yale University. His main interest has been in topological groups, including Lie groups, in transformation theory and related fields. His work has been recognized throughout the world and is attracting scholars to the Institute from many lands.

Atle Selberg, born in Norway, became a permanent member of the Institute for Advanced Study in 1949 and professor in 1951. His earlier studies led him into the congenial mathematical company of Carl Ludwig Siegel. His scientific production, centering in analytic number theory, is deep and extensive. Under his influence, now to be combined with that of Beurling, the Institute is becoming a center of study in analytic number theory.

Hassler Whitney rose from the rank of instructor in mathematics at Harvard in 1933 to professor in 1946. He became professor at the Institute in 1952. His interest has been mainly in topology and its applications to differential manifolds. He is fundamentally a pioneer with profuse and fruitful ideas. Recently he has been led to a theory of r -dimensional integration.

Arne Beurling came to the Institute for Advanced Study as a member in 1951, and has just been appointed professor of mathematics. From 1937 to 1951 he was professor of mathematics at Uppsala. He had established himself as one of the great leaders in modern mathematics long before he came here. He has originated some of the most fertile ideas in conformal mapping, harmonic analysis and analytic number theory. His presence here gives additional breadth and unity to the mathematical influence of the Institute.

~~2~~

The place and influence of the School of Mathematics in the world of mathematics is evolving rather than static. The School is not a graduate school, ~~not~~ a place where a student receives his first advanced training and orientation. It is a place where scholars of all ages with varying degrees of flexibility and maturity come to give and to take whatever seems to them to be significant. The exchange is as much between the visiting members as between these visitors and the professors of mathematics. Some of the most intense mathematical exchanges at the Institute today take place in seminars conducted by members. Another mode of exchange is found in the writing of joint papers. In the last ten years Professor Morse, for example, has written more than twenty papers in collaboration with visiting members of the Institute.

The Mathematics Faculty of the Institute has contributed its share in the creation of the moving mathematical ideas of our day. This has been specifically acknowledged in the fields of logic, number theory, information theory, topology, and in the influence of variational theory on topology. The lectures each fall of our part-time member, Jean Leray (Professor at the Collège de France), are making an historic impression in the field of partial differential equations. Professor Weyl continues his lectures at the Institute each second term, giving freely of the wealth of his great scholarship.

In bringing young mathematicians here from Europe the Institute has depended heavily on the knowledge of the European scene of Professors Weyl and Leray, and of ~~our good friend~~ Professor Heins Hopf of the University of Zurich. The results have been most fortunate. Mathematicians also ~~like~~ to come to the Institute on sabbatical leave. Distinguished mathematicians from the Universities of Chicago, California, and Cambridge, England, are expected to so come next year. In general the reduced salaries of these visitors have to be supplemented with Institute funds. *Y. M. G. v. a.*

? a The Institute is performing another service. Four mathematicians who are now professors of mathematics in major graduate schools first came to the United States from abroad to spend a year of study at the Institute for Advanced Study and thereafter took their present positions. This is an illustration of the significant relation which has been established between the Institute and American universities.

SCHOOL OF MATHEMATICS

During the period covered by this report there have been some 300 mathematicians who have been members of the Institute. They come to us not only from the United States, but from almost all parts of the free world, from Western Europe, from Latin American and from Asia. Their work has resulted in the publication of more than 500 papers in the learned journals of mathematics. Their association with the Institute has in many cases greatly broadened the mathematical background of the members and ~~there~~ thus helped the progress of mathematical science in the universities and institutes here and abroad from which the members have come, and to which they have returned.

SCHOOL OF MATHEMATICS

Theoretical Physics

(RO)

- 5,6,7,8 -

Physics

In the years 1948 to 1953, there has been a marked growth in the work of the Institute in theoretical physics. This was a natural development for the Director to undertake. It has been supported throughout by faculty and trustees. The Institute has always had a few members interested in theoretical physics. This was inevitable in a school of which Einstein was a first member, and which Pauli and Bohr visited from time to time. But both the scope and the character of the work have changed. We have appointed two professors, Freeman Dyson and Abraham Pais; we have made arrangements for a continuing or recurrent association with the Institute for a number of physicists: N. Bohr, P. A. M. Dirac, Res Jost, G. Placzek, W. Pauli, L. Van Hove and C. N. Yang. The number of annual members has increased rapidly; in 1953, we had about 25 men in this field working at the Institute; and in the whole period, we have had about a hundred such members. Their work has eventuated in the publication of ^{between one and two} ~~considerably over a~~ hundred papers in the Physical Review and, to a more limited extent in other technical journals.

The members in physics, ^{wh} ~~that are~~ selected by the physics faculty, come to us from many places, and in many different stages of their work. A few of the most brilliant post-doctoral students in the country come here for a year or two of further study; a few come to us on leave from assignments involving serious administrative duties with the government or with industrial laboratories, and have a ^{an opportunity} ~~chance~~ both to complete work which they have wished to undertake, and to learn of the new things that are under development. Many are scientists from abroad. In fact, it ^{was} ~~is~~ in physics that we first reestablished effective and continuing contact with the Japanese ^{scientists} physicists. We have had extremely brilliant young Chinese, who have immigrated from China after the war. ^{Members come} ~~Men~~ from India and Pakistan, and from almost every country of Western Europe, ~~come~~. Very often members in physics, as in other subjects, have the support of their own governments, or an agency of the United States Government, such as the National Science Foundation, or of fellowships given by American universities or foundations. [The work in physics is coherent, but not organized. ^{There are} ~~We have had~~ seminars of two kinds; one is a continuing seminar, ~~with~~ meetings whenever the Institute is in session, on problems of current interest, on the work of members, or more rarely on work done elsewhere

which we need to hear and discuss at first hand. The other seminars ^{are} ~~will be~~ devoted to a theme, usually one which is in need of critical review and analysis, and may continue for a month or a semester.

Among ^{physicists} ~~those~~ permanently associated with the Institute ~~in physics~~, it is ~~very~~ appropriate to mention a few examples of ~~their~~ achievement. Dyson has made searching analyses of the mathematical consistency and meaning of the fundamental theories of matter. It was he who first showed in what sense the quantum theory of electrons and electromagnetic radiation could be interpreted ~~ed~~ in a mathematically coherent way to explain a vast range of physical phenomena. He has initiated searching enquiries as to the ultimate consistency of the theory of nuclear forces and made important advances in the application of this theory to the most recent experimental findings. Pais has for ^{many} years devoted himself, among other things, to the problem of the nature and structure of the elementary particles of physics. Some of his major contributions have been critical and negative, in showing that ~~an~~ earlier suggestions describing the structure in space and time of primordial problems were neither logically consistent, ~~nor~~ in agreement with experience. His most recent efforts have been devoted to a new description of the structure of matter, which at best is only a first step in the solution of this great problem, but which at ~~present~~ ^{does} ~~shows many striking indications~~ ^{Some} ~~throws~~ ^{much} light on the true properties of these objects as they are observed in nature. It is probable that a real solution or even a major advance in the description of elementary particles and their interaction is a task which will take years for its accomplishment, years of mathematical improvisation on the one hand, and of analysis and synthesis of experimental findings on the other. Placzek has continued brilliant ^{critical} and highly successful studies

~~studies~~ of scattering phenomena, particularly where they are determined by the properties of matter in bulk, ^{of} ~~by~~ crystals and liquids. He has brought order and enlightenment to many of the darkest corners of this field. Yang's work has touched on so many themes and with such success that a summary is ^{inadequate.} ~~difficult.~~ ^{It ranges from} ~~It ranges from~~ contributions ^{range from} ~~to~~ the theory of elementary particles and their stability, to the problems of order and disorder, ferromagnetism, and ^{to} ~~the~~ theory of condensation and of changes of state.

The principal subjects of work in theoretical physics at the Institute have had to do with the structure, nature, interactions, description and theory of the primordial particles of which matter is composed. But there has been much work of a methodological nature, especially in quantum electrodynamics and in the so-called meson theory of nuclear forces. There has been work on classical nuclear physics, on statistical mechanics, on problems of order and disorder, condensation, the solid state and the strange phenomena of superconductivity and superfluid helium. In a few cases there has been extraordinarily fruitful collaboration between theoretical physics and pure mathematics; and among many members there is a substantial community of interest and knowledge between these two disciplines.

SCHOOL OF MATHEMATICS

Applied Mathematics

(J. von Neumann) EP

ES

the Electronic Computer 1946-1953

has
In 1946 JvN_A organized a group to develop and construct at the Institute a large-scale, high-speed electronic computing instrument which could be used as a new tool for the mathematician. In view of the difficulties that beset researchers in the field of non-linear mathematics for the last half century, an electronic machine of suitable size and speed may be used toward gaining those heuristic insights which are the first steps in the direction of an exploration of ^a ~~this~~ field. With the goal of obtaining a machine with ^{adequate} ~~such~~ characteristics, the group undertook an engineering research and development program which culminated in January 1952 with the completion of a machine. This machine was the prototype for a number built by various government agencies. It has also contributed ideas to a number of other groups which have produced comparable instruments.

Concurrent with the engineering program, another small group studied the logical problems connected with the design of the machine and the final instrument reflects the interplay between the two groups.

As a continuing effort, some mathematicians have been working with JvN to develop those numerical techniques required by the particular characteristics of the new machines. They also make extensive use of the machine to test out these techniques. A variety of problems has been run, including some of interest to the pure mathematician, as well as a considerable number of interest to the applied mathematician. These include number theoretical, hydrodynamical and astrophysical problems, as well as the meteorological work described below.

Since the completion of the machine, the major emphasis of the entire project has shifted to operation of the machine and to further improve-

ments of its organization and components. These activities are proceeding in a cooperatively fruitful fashion.

The Institute has been fortunate in being ^{supported} ~~sponsored~~ ^{These} in its activities by a number of government agencies ^{that a} having great interest in computational problems. Its major efforts, the machine construction and operation programs, are supported by the Ordnance Corps, U.S. Army; the Office of Naval Research, U.S. Navy; the Air Research and Development Command, U.S. Air Force; and the Atomic Energy Commission under contracts with the Ordnance Corps. The Institute has each year made substantial financial contributions to this program. The mathematical work has been sponsored by the Office of Naval Research, U.S. Navy, since 1947.

The entire planning and construction program has been made possible by the joint efforts of Mr. J.H. Bigelow, Dr. H.H. Goldstine, Mr. J.H. Pomerene and JvN, together with a ~~changing~~ staff of electrical engineers. ^{under the supervision of} The present program is being undertaken by a senior staff consisting of Mr. Pomerene, together with Mr. H.D. Crane and Dr. S. Y. Wong. ^{Summary}

Meteorology Project 1946-1953

The Meteorology Project was established concomitantly with the Electronic Computer Project in 1946, with the expectation that the computer would be a powerful research tool in the investigation of fundamental problems in dynamical meteorology, and would make possible for the first time a direct attack on the problem of weather prediction by numerical solution of the hydrodynamical and thermodynamical equations governing the motion of the atmosphere.

It was decided in 1948 that the complex of mathematical and physical problems of numerical prediction could best be solved by studying in turn each

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of a sequence of successively improving idealized mathematical models of the atmosphere. Despite the very simplified character of the first models, results of considerable theoretical and some practical interest were obtained as early as 1949. The first attempt to use an electronic computer for numerical prediction was made in 1950 on the Eniac, an instrument made available by the Ballistic Research Laboratories of the Aberdeen Proving Ground. The results were encouraging and led to the construction of models of greater complexity for use with the Institute computer. After its completion in January 1952 the Institute computer was used extensively for a series of numerical experiments which culminated in early 1953 with the development of a model by means of which one was able to solve the problem of the prediction of storm generation (cyclogenesis), the chief obstacle that had stood in the way of accurate weather prediction. With respect to this, our crucial experiment was the correct calculation of the great Appalachian storm of November 25, 1950. Similar success was also obtained in the two subsequent calculations of this type that were undertaken: Those of the storms of November 12, 1952 and of November 5, 1953, both in the eastern U.S. At this stage there was no longer any doubt that these numerical methods were more accurate than all existing, standard methods. Therefore, the civil and military weather services of the United States government decided in late 1953 to organize a Joint Numerical Weather Prediction Unit in Washington, D. C. to put into practical operation the methods developed by the Project.

Concurrently with the short-range prediction studies, a series of investigations were made of the factors governing the long-range evolution of weather. These studies are essentially attempts to understand what produces the circumpolar band of strong westerly winds at middle latitudes and their

quasi-stationary mean perturbations. It was demonstrated, that the traveling low- and high-pressure systems (cyclones and anticyclones) act as turbulent eddies transferring the potential energy derived from solar radiation into the kinetic energy of the mean westerly winds, and thus maintaining them against frictional dissipation. The study of the effects on the mean air flow of friction, heating, and continental obstacles led to a theory which is in encouraging agreement with the observed perturbations of the westerlies.

The work of the project has stimulated meteorologists elsewhere toward similar efforts in numerical meteorology. There are now active centers of academic research in this field in England, Norway, Sweden, Denmark, Western Germany and Japan.

The project was supported financially originally by the Office of Naval Research, and since 1951 jointly by the Office of Naval Research and the Geophysics Research Division of the Air Force Cambridge Research Center. It has had the good fortune to secure the collaboration of visitors of outstanding ability from the Universities of Chicago, Oslo, Stockholm, Copenhagen, London and Tokyo, and from the U.S. Weather Bureau.

The Meteorology Project has been under the immediate direction of ^{J. Neuman} ~~Julie~~ Charney and JvN. Important contributions were made to its work by N. Phillips and several temporary members, of whom A. Eliassen (University of Oslo), R. Fjørtoft (University of Copenhagen) and J. Smagorinsky (U.S. Weather Bureau) should be particularly mentioned. The advice of C.A.G. Rossby, now at Stockholm, generously given throughout the years, has been most valuable.

General

The work of the Institute in applied mathematics has received

valuable support by a gift of the I.B.M. Company of \$20,000 for 5 years,
since ^{1949.}~~1952.~~

SCHOOL OF HISTORICAL STUDIES

There is no work in the School of Historical Studies as extensive — and at the same time concentrated and coherent — as that in pure mathematics or in theoretical physics. We do not in any sense "cover" historical studies, as we do try to cover pure mathematics. What we have sought ~~to~~ ~~do~~ is to encourage work in areas of historical research which are manifestly fruitful, and ^{in which} ~~where~~ a very high level of scholarly (excellence)?, intellectual interest and ^{fundamental historical} ~~historical~~ discovery ~~are assured.~~ ^{are assured.}

Archeology - Thompson - page 15, 16, 17

Greek Philosophy - Cherniss - page 18

Neugebauer - Cherniss - page 19

Lowe - Cherniss - page 20

Kantorowicz - page 21

Panofsky - page 22, 23

< Archaeology >

The scholarly resources of the Institute ~~are made to~~ play a vigorous part over a wide range in the fields of Greek Archaeology and History. The library, ~~rapidly~~ ^{increasingly accurate &} becoming ~~very~~ useful, the files, records and pictures of current excavations, and the opportunities offered to ~~foreign~~ ^{from abroad} scholars to ~~join us~~ ^{have all made} are building ^{this} up here a centre for work in the classical fields. The results of research ~~started elsewhere~~ ^{initiated in other institutions, &} and new material from ^{current} excavations are gathered, assimilated, subjected to comment and criticism and presented through publications to both scholarly and lay audiences. The fruition of such cooperation and collaboration is proving to be far richer than the work of an isolated scholar.

This work has not been limited to any single period. In the field of Prehistory, Professor Goldman and her collaborators have been studying and publishing the valuable results of the excavations at Tarsus in Asia Minor. Professor Wace, formerly of Cambridge, during the past few years has been illuminating, by his excavations at Mycenae, which he studies and publishes here, the earliest stages of Greek civilization. In the general field of Greek history work has recently been done on the early history of Greece, on Ionia, on papyrological problems, and on the calendar. Publications by the American School of Classical Studies at Athens, ^{whose headquarters} ~~of which the~~ ^{are maintained at} office is generously provided by the Institute, have included works on excavations, on mediaeval castles and on early travelers in the Levant.

Attention is being given particularly to the publication of recent discoveries in Greece, especially those at Corinth and Athens.

Members of the School of Historical Studies who come to work with Professor Meritt or Professor Thompson have assisted in evaluating this new material. Many of these have come from Oxford and Cambridge, others from the Greek Archaeological Service, and a goodly number from France, Holland and other parts of Europe.

One large field of study which occupies many members is the history of the ancient city of Athens. The records of the Agora Excavations of the American School of Classical Studies, of which duplicates are now housed here, provides a wealth of material on all subjects. Professor Meritt and his associates have concentrated on the epigraphical documents, of which they have a unique collection of copies. These they have used as a basis for the study of the Athenian tribute lists and thus put on a sound basis that important field in the history of fifth century Athens. They are also studying the statistics and personnel of the Athenian population. Since the new documents from Athens alone amount to some 6700 items, the possibilities inherent in the publication of this body of material are ^{very great.} ~~unlimited~~. The political, financial, and military history of Athens is therefore continuously under reexamination by the various members from year to year.

Professor Thompson and his associates devote themselves chiefly to the study for publication of the other material from the Agora Excavations. Professor Thompson directs not only the field work in Athens, for which he is given leave of absence by the Institute, but he organizes and supervises the publications. With the collaboration of ^{a number of} ~~various~~ members, he is directing the study of ceramics, sculpture, numismatics, literary testimonials, and various

minor arts. He himself makes the topography and architecture his especial interest. He also endeavors to make all aspects of these studies ~~also~~ available to the layman, by giving illustrated lectures and by writing for more popular journals. In this way, the results of scientific investigation are brought to bear upon the work of scholars and upon the thought of the people of to-day.

*In the period covered by this report,
✓ Some of our members have work at the institute
on archaeological problems.*

Cherniss

Knowledge of the ancient Mediterranean world and especially of ancient Greece is significant and important not only because modern European or Western civilization is a lineal descendant of the Greek but also because the development of Western thought and institutions even during the Middle Ages, ~~but~~ ^{and} especially since the Renaissance, has repeatedly been inspired and influenced anew by direct contact with the literary and artistic monuments of that ancestral civilization. ~~Like the unseen sap that makes a living whole of the tree from root to leaf the~~ ^{are} integrating factor of that ancient civilization itself and of its ~~efflorescence~~ ^{flowering} in Western civilization ~~is~~ ^{are} Greek philosophy and science in the broad ancient sense of these terms. ~~Soon after Dr. Oppenheimer became Director of the Institute it was decided to make provision for these studies and so to supplement the work in Greek history, archaeology, and epigraphy already being intensively pursued here; and for this purpose Professor Cherniss was appointed, in 1948.~~ ^{In 1948} From 1949 onward an increasing number of scholars working on special problems in ancient philosophy and science have come on annual appointments to the Institute from various universities in this country and in Europe and have worked in consultation with ~~Professor~~ Cherniss and in occasional, informal seminars.

^{by Cherniss & in consultation with him}
Besides the work done [^] on Plato, Aristotle, and the ancient interpretations and developments of their philosophical and scientific thought, special studies have been made of the sources for the history of ancient philosophy. This is a subject complicated by problems of text and interpretation and in many cases requires at the outset new editions. Some of our members have devoted their time to the preparation of such critical editions of

Diogenes Laertius, the fragments of Theophrastus, and the philosophical and scientific essays of Plutarch. Others have concerned themselves more especially with the transmission of Greek philosophy and science through the two main intermediary literatures, Arabic and Latin. ~~So~~ ^{Thus} the tradition of Greek thought has been studied on its way to mediaeval Europe by the indirect as well as by the direct route.

Certain aspects of the Mediterranean scientific activity that antedates the Greek, and of the influence and counter-influence of ancient Greek and non-Greek science, have also been intensively studied. Professor Neugebauer, who was a member of the Institute several times before 1948 and who since 1948 has been in residence regularly for one term out of every four, has worked with other members on Greek, Muslim, and Hindu astronomy, has collaborated with another member in the publication of a book on the Greek calendar, and has recently completed his monumental corpus of Astronomical Cuneiform texts.

Meanwhile the technical aspect of Latin literary transmission continues to be studied. Professor Lowe, though he has been emeritus for ~~several~~ ^{some} years, has steadily proceeded with the publication of his definitive work on Latin palaeography, the Codices Latini Antiquiores, the sixth volume of which appeared in 1953. Other members have worked with ~~Professor~~ Lowe on special problems in Latin palaeography or have themselves applied the principles of this science, which he has done so much to advance, to the edition of mediaeval Latin texts. ^{Lowe's intensive and} ^{in fact} fruitful work well illustrates how little retirement from the host takes faculty, terminates or disrupts this a scholar's ~~life~~ professional life.

MEDIAEVAL HISTORY

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Mediaeval History, for the first time permanently represented through the appointment of Professor Kantorowicz in 1951, has during the last six years been the field of interest of at least nine temporary members besides those engaged in mediaeval art and musicology.

Intellectual history. The great problem of transition from Late Antiquity to the Christian Age as well as that of the continuity of the classical tradition in both Byzantium and the West has naturally attracted the attention of several members. A major work on the notions Reformation Renovation, Renaissance has been begun at the Institute and has yielded a number of preliminary studies in which the patristic background of those notions has been disclosed. Two studies on Image Worship and the ensuing Iconoclast Controversy in Byzantium were published in connection with the edition of source material relevant to that problem. Imagery was a matter of politics, and its political character has led to studies on the Ruler Image in late antique and Carolingian times. While the continuity of the antique Ruler Cult in Christian guise formed the subject of several studies, Mediaeval Learning has not been neglected: some of the leading Theologians and Scholars of the Carolingian period have been studied by a temporary member, and another scholar devoted his time at the Institute to the study of the literary and pictorial sources of Students' Life at mediaeval universities.

Political history. Mediaeval studies have their peculiar difficulties. The advantages of classical scholarship with its long tradition of text criticism, its highly developed and well organized apparatus of auxiliaries and its relatively controllable amount of literary sources are not those of the mediaevalist; nor can the mediaeval historian approach his subject straightforwardly from a chiefly political or diplomatic point of view, as

would seem justified in the case of the modern historian. Interposed problems of religion and dogma conditioned that period in its entirety, and there is little hope to understand the complexity of mediaeval political problems without the concurrent study of theology, liturgy, scholastic philosophy, or canon and civil laws with their glosses -- branches of knowledge from which modern mind has been moving away, ever since the 17th century, so rapidly that their specific value for political history, obscured by a long tradition, cannot easily be recovered. Legal and theological sources, however, have yielded a considerable amount of new information for a number of studies devoted to Constitutional History, and have been of major importance for a book on mediaeval Political Theory, or Political Theology, which is nearing its completion.

Text editions. Intellectual history and the history of political ideas, however, did not monopolize mediaeval historical studies. In addition to the evaluation of literary texts, which an eminent European scholar could continue at the Institute, and studies on Chaucerian England, the Texts themselves called for students. Texts, badly edited or not edited at all, must be made accessible by means of critical editions, and this Philological Work remains an important task of the mediaeval historian, whose work in this respect is akin to that of the classical scholar rather than of the modern historian. A new, and perhaps the final, edition of Geoffrey of Monmouth's fabulous, if influential, "History of the Kings of Britain" has been published with the support of the Institute. A source related to the times of the Investiture Struggle occupies a temporary member, while another visitor is engaged in the edition of some hitherto poorly known Political Writings of the later Middle Ages.

There is no lack of variety in mediaeval studies, and the Institute's stimulus cannot easily be underestimated. For in all those endeavors the exchange of ideas and material with other members engaged in the study of Paleography, Mediaeval Art and Music, or in that of Near Eastern - Iranian and Arabian - Philosophy has proved to be invaluable.

Panofsky

HISTORY OF ART

During the last six years the group of scholars exclusively or preponderantly engaged in art historical studies included, in addition to the two permanent members (Professors Panofsky and Weitzmann), fifteen temporary members, among them leading art historians from France, West Germany, Holland, and Sweden.

Since works of art reflect cultural situations in all their aspects, the research of this group was varied and strongly individualized in subject matter and scope. No formal "projects" or "programs" were launched, and there was no limitation as to media. While considerable emphasis was placed on factual problems solvable by means of archaeological investigation, stylistic analysis, and iconographic interpretation, no less attention was paid to the study of the interplay between art and literature, theology, philosophy and science; in this respect the peculiar character of the Institute, favorable to the cooperation of scholars and scientists active in widely different fields, proved to be of inestimable advantage. On the other hand, the work of the individual members, for all its independence, frequently overlapped or interpenetrated, owing to an affinity of subject matter, and was always unified by personal contact and a community of methodical convictions. We have tried to avoid the danger of dilution and over-expansion by subjecting our work to the requirements of a strictly historical discipline and by restricting it to the spatial limits of the Roman Empire and the temporal limits of the periods known as the Middle Ages, the Renaissance, and the Baroque.

22

The work of the group encompassed mediaeval architecture (including its relation to contemporary thought and its evaluation in later centuries), book illumination, sculpture, glass painting, and what our own age somewhat unfairly refers to as "the minor arts"; Early Christian and Byzantine painting and book illumination; Northern painting and book illumination in the 15th and 16th centuries; Rembrandt and his Netherlandish contemporaries. On the other hand, intensive study was devoted to such more general problems as classical survivals and revivals in post-classical art and literature and the changing theological and philosophical attitudes towards the visual arts. In the last two years a successful attempt was made to bring the music of the Middle Ages, the Renaissance and the Baroque into the orbit of art historical studies.

A great number of art historical books and articles published between 1948 and 1953 resulted, wholly or to an essential part, from the authors' activities at the Institute. Mention may be made of three important books on Early Christian and Byzantine painting and book illumination by Professor Weitzmann (Princeton, 1947, 1948, 1951); of Dr. de Tolnay's Michelange (Paris, 1951); of Professor George H. Forsyth's monumental monograph, The Church of St. Martin at Angers (Princeton, 1953); and, ~~perhaps~~, of Professor Panofsky's Early Netherlandish Painting; Its Origins and Character (Cambridge, 1953, developed from the Charles Eliot Norton Lectures delivered at Harvard University in 1947/1948).

Modern History

The work in modern history has prospered. It has been ~~immensely~~ strengthened by the election to the faculty of Sir Llewellyn Woodward, ~~and by~~ the continuing and recurrent ^{among others} membership of the distinguished British historian, C. Veronica Wedgwood, and the French Geographer, Jean Gottmann. Professor Earle has continued with his well-known seminar method which he developed in the early days at Columbia. There have been seminars on the Dynamics of Soviet Policy, on the Causes of American Entry into the First World War, on the Decline of Liberalism as a Political Philosophy, and on Modern France. The scholars who have come to attend these seminars have of course in the first instance continued the researches which were of interest to them. The seminars have served to stimulate, to correct and to collate. There have been some forty members during these years in the field of modern history, including a few like Kennan and Feis who have first come as stipendiates under the Director's Fund, ^{as} which will be described below. These memberships have led directly to the publication of some twenty volumes and have contributed to the publication of some twenty others.

Woodward

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Sir Llewellyn Woodward is also editing (with Mr. Rohan Butler of All Souls College, Oxford), at the invitation of the British Foreign Office a series of volumes of 'Documents on British Foreign Policy, 1919-39.' Six of these volumes - dealing with British policy in Europe in 1938-9 have appeared since Sir Llewellyn Woodward's membership of the Institute. Other volumes are in course of publication. Owing to the nature of the material this editorial work has to be done mainly in the archives of the British Foreign Office, and for this purpose Sir Llewellyn Woodward has visited England each year during the long vacation of the Institute.

RO -

The Schools & The Director's Fun.

^{Until} 1948, the academic life of the Institute was divided into

three schools: a large and growing School of Mathematics, which included

of which mathematics

& physics and was to include more and more of it; a relatively small School

than

of ^{*Humanistic*} Historical Studies, ^{*concerned with*} ~~centered in~~, but not confined to archeology; and a

classical paleontology & the history part;

School of Economics and Politics, with three professors of economics and

one of modern history. ^{*Circumstances were*} ~~This was~~ soon to change. (Professor Warren died;)

Professor Riefler resigned to reenter the Federal Reserve System; and

Professor Stewart retired, ^{*and now*} ~~which ultimately led to his~~ ^{*sever*} ~~serving~~ on the

President's Council of Economic Advisers. But even before these

evidences had changed the complexion of the faculty, we had had serious

consideration of the proper direction of the work of the Institute in

fields other than mathematics and physics. We were ^{*led to doubt whether*} ~~persuaded~~ that the

Institute, limited in facilities for statistical and economical research,

divorced from students and from current affairs, was ^{*a library*} ~~probably not~~ an

^{*systematic, continuing*} ~~ideal~~ site for advanced work in economics on a ~~continuing~~ basis. It

obviously is and has remained a desirable place for ^{*may*} economic studies

of limited ^{*extent, & for economic history.*} ~~duration.~~

We further became convinced that the unifying and ~~in~~ invigorating

element of work in history and the humanities must be the ~~conscientious~~ ^{considerate & scrupulous}
use of the historical method; and that a school devoted to this purpose
would, for all its heterogeneity, be a proper complement and balance to
the school devoted to mathematical ^{+ logical} analysis. Thus in the autumn of 1949,
the academic work of the Institute was reorganized to correspond to two
schools, a School of Historical Studies and a School of Mathematics.
We have found these themes broad enough to provide a framework for all
the undertakings on which we wished to embark.

Director's Fund

It is manifest that an institute conceived like the Institute
for Advanced Study, whose faculty numbers no more than fifteen or
twenty, will not have on its faculty representatives of all disciplines
which could fruitfully be pursued at an institute for advanced study.
We have deliberately excluded from our work the sciences that require
extensive experimental facilities. Their cost, scope, maintenance
and skill are wholly at variance with our budget and practice.
Nevertheless occasions arise on which an experimental scientist can and
does profit from a year or more of freedom for analysis, criticism and
writing in order to get the results of his past work *understandable & so* in form for
publication. We have already alluded to the absence at the Institute
of adequate facilities for economic and statistical research. Yet
often economists can and do find a period at the Institute useful.

There are many fields in which we could well be active, but which
happen, for reasons of history or accident, not to be represented on our
faculty. It has been the continuing policy of the Institute, where
possible without interference with its other programs, to support such
undertakings. Where the Institute's funds are not involved, the faculty

has been glad to vote membership to obviously competent and distinguished

men from ~~other fields~~ ^{of true scholarship}.

From 1948 on, however, we have had, in the form of the Director's Fund, a ^{means} ~~way~~ of providing ^{grants} from Institute funds, which would not be

directly competitive with the stipend funds of the schools. In this

way some twenty men have been brought to the Institute in the ^{intervening} ~~following~~

years: in biology, in philosophy, in the history of ideas and literary

history and criticism, in law and in contemporary history. ^{Members whose} These memberships,

work is supported by the Director's Fund or by Foundations ~~are~~ ^{are} never - which include some of the most eminent of those who have come to the

~~Phelers elected to~~ ^{memberships by the Faculty of the Schools which they work} Institute, ~~very~~ often lead to the publication of a book and at least in

^{Such members have written, among many others, at least a few books of} some cases ~~to a book~~ ^{these have relatively} of wide interest and circulation. Examples are

Herbert Feis, "The China Tangle"; George Kennan, "American Diplomacy";

Francis Fergusson, "The Idea of a Theatre".

^{These appointments have served,} not only to extent, but to add coherence to the work of the Schools, in particular

We have found the foundations, particularly the Ford and Rockefeller

Foundations, most helpful indeed in supporting these undertakings; and it

is our determination to continue them.

In some cases, we have found it desirable to appoint an advisory

committee to consult with us about the qualification of members. This we

have done in psychology*. In others ^{fields} our own faculty and those whom we can

*E. G. Boring, Harvard; J. S. Bruner, Harvard; H. S. Langfeld, Princeton; P. E. Meehl, Minnesota; G. A. Miller, MIT; E. C. Tolman, Berkeley; R. S. Tolman, Pasadena.

readily consult provide counsel.

make possible a year
The Director's Fund has also ~~been used~~ for preliminary conferences ~~<~~
in law, in contemporary history and in psychology, for instance, which
were helpful in determining our proper course, ~~in these fields.~~

The Community of Scholars. General

The varied work of the Institute is, of course, specialized.

No advanced study or deep scholarship can be other. We make no attempt, and indeed can make no attempt to provide formal channels of liaison or what is unhappily called integration. There have been indeed some instances of unexpected and unpredicted collaboration, ^{was} as that between the French Dominican, ^Q Father ^{Linguist} Jean de Menasse, and the French mathematician, ^B Benoit Mandelbrot, on the theory of languages. But it is not in such exceptions ^{not by such means} that the essential community ^{of the members of the Institute} is to be found.

~~The members of the Institute are a community none the less.~~ ^{from} They are a community because many members have in effect ranging and wide ^{understanding &} interests, and some substantial knowledge outside their own field of specialization.

~~They are a community because~~ ^{of} close friendships ~~are inevitable which~~ contribute to mutual understanding and common interest. The fact that most of the members of the Institute live in the same apartments, eat in the same restaurant, share the same common room and the same library helps to bring them together. The members of the Institute are of course also a part of the larger community of Princeton, with its university and its many institutions of research and learning.

We do from time to time ^{summarize} ~~have~~ general lectures, intended for ~~all~~

members and their guests, to give in not too technical terms an account

B of progress in one or another field.

Relations with Princeton University

Although the Institute has no administrative or organic connection with Princeton University, there has been very close collaboration in

matters of common interest; and we have sought to take advantage of each

~~its~~ others facilities in the freest possible way. All Institute seminars

are attended by ^{in most members} ~~those from the University~~ ^{Faculty & Graduate Schools} ~~who are interested, and the~~

University seminars and conferences are frequently attended by Institute

members. There are many cases of collaboration in research between the

Institute and the faculty of the University. Several distinguished

members of the Princeton faculty have elected to spend their sabbatical ^{year}

^{or semester} in residence at the Institute. We have had for some years a standing

inter-faculty committee to consult on problems of common interest. We are,

of course, vastly in debt to the University, without which ~~this~~ ^{Princeton}

^{itself} ~~community~~ would be both physically ~~beyond~~ and intellectually far less

adequate for our own undertakings.

Plant

There have been no radical changes in the Institute's physical plan² in the years covered by this report. The Institute has grown, and in response to this growth, we have erected three modest buildings. They have had the triple function (a) of providing study and office space ~~for~~ the increased number of members, (b) of allowing the library to expand from its original confines to adjacent rooms in the main building, Fuld Hall, and (c) of providing rooms for consultation, conference and seminars. They have given us about sixty new offices and two new conference rooms, and have been arranged so that continued physical expansion will lead to an open, bell-shaped array of buildings with the opening facing south ^{toward the woods} and Fuld Hall at its ^{apex} ~~vertex~~. The cost of these buildings has been about \$400,000. The library itself has grown rapidly, from 24,000 to 40,000 volumes, though we still keep it as a working library, only adding volumes for which professors and members have recurrent and important use, but in no sense attempting completeness even in limited fields. We still depend decisively on access to the Firestone Library of Princeton University, to whose construction we contributed a half a million dollars, without which our problems of

adequate access to books would be almost unmanageable. We were fortunate to receive ~~from Lessing~~ ^{Mr Lessing Rosenwald} Rosenwald, a trustee of the Institute, a ^{valuable} collection of early editions of scientific texts. This is housed in a separate room of the library, and is much used by historians and scientists alike. To this we are adding in an orderly and modest way.

The only other items of addition to plant during these years are two: a shop and garage building for the maintenance and storage for the Institute's equipment and transportation, and a sizeable addition to the building in which the electronic computer is housed, an addition which provides a permanent site for the computer itself, and additional office space for the scientists and coders who make use of the computer for meteorological and other studies, or ~~individuals~~ ^{machine itself.} who are contributing to ^{the} ~~its~~ improvement and further development. There has been no addition to the housing available to the Institute for its contemporary members; and this constitutes a troublesome deficiency in our present plant.

<u>Member</u>	<u>PUBLICATION</u>	<u>DATE</u>
BARON, Hans	"The Crisis of Early Italian Renaissance"	1953?
BAYKOV, A. M.	"Soviet Foreign Trade"	1946
Cooper, J. C.	"The Right to Fly"	1947
Schiffer, Walter	Book now in press on the Concept of Leagues (of Nations)	
Carr, E. H.	"The Bolshevik Revolution, 1917-23" (3 vols to appear in '52-53)	
	"German-Soviet Relations between the Two World Wars" 1951	
Levi Morris, R. B.	"Freedom and Labor in the Slave States" (to appear in 1955)	
Toynbee, Arnold	"Religio Historici"	
	"A Study of History" Vols. 7-11	
Beuhrig ,		
Beuhrig, E. H.	"Our First European Intervention, 1917"	(to appear)
Coale, Ansley	"Measurement in Economics" (in progress)	
Ciriacy-Wantrup, S.	"Resource Conservation: Economics & Policies"	
Fleming, Denna F.	(has written 2 books; Miss Sachs is looking these up)	
Davis, Joseph-	"Consumption Economics" (to appear in '54?)	
Feis, Herbert	"The Road to Pearl Harbor,"	1950
	"The China Tangle"	1953
Gottman, Jean	"A Geography of Europe"	1950
	"La politique des Etats et leur geographie" Paris	1952
Marx, Danniel	"International Shipping Cartels"	1953
Robbins, Lionel	"The Theory of Economic Policy in English Classical Political Economy"	
Byrnes, R. F.	"Anti-Semitism in Modern France," Vol. II (The Drifus affair)	1953?
Chevallier, J. J.	"Evolution des ideologies politiques depuis 1914 et influence de cette evolution sur les regimes constitutionnels et les relations internationales"	1953?
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THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF HISTORICAL STUDIES

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Members for Professors Thompson, Goldman and Meritt: 1948-53.

Professor Goldman has been retired most of this time. The members, in addition to our assistants, have varied in number per year from four to ten--giving an average of $6\frac{1}{2}$ --and over the years two of these members have been Miss Goldman's and the rest are Thompson and Meritt's. This covers the last six years.

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There are many fields in which we could well be active, but which happen, for reasons of history or accident, not to be represented on our faculty. It has been the continuing policy of the Institute, where possible without interference with its other programs, to support such undertakings. Where the Institute's funds are not involved, the faculty

has been glad to vote membership to obviously competent and distinguished men from other fields.

From 1948 on, however, we have had, in the form of the Director's Fund, a way of providing grants from Institute funds which would not be directly competitive with the stipend funds of the schools. In this way some twenty men have been brought to the Institute in the following years: in biology, in philosophy, in the history of ideas and literary history and criticism, in law and in contemporary history. These memberships, which include some of the most eminent of those who have come to the Institute, very often lead to the publication of a book and at least in some cases to a book of wide interest and circulation. Example are Herbert Feis, "The China Tangle"; George Kennan, "American Diplomacy"; Francis Fergusson, "The Idea of a Theatre".

We have found the foundations, particularly the Ford and Rockefeller Foundations, most helpful indeed in supporting these undertakings^s₁ and it is our determination to continue them.

In some cases, we have found it desirable to appoint an advisory committee to consult with us about the qualification of members. This we have done in psychology*. In others our own faculty and those whom we can

*E. C. Boring, Harvard; J. S. Bruner, Harvard; H. S. Langfeld, Princeton; P. E. Meehl, Minnesota; G. A. Miller, MIT; E. C. Tolman, Berkeley; R. S. Tolman, Pasadena.

readily consult provide counsel.

The Director's Fund has also been used for preliminary conferences in law, in contemporary history and in psychology, for instance, which were helpful in determining our proper course in these fields.

Physics

In the years 1948 to 1953, there has been a marked growth in the work of the Institute in theoretical physics. This was a natural development for the Director to undertake. It has been supported throughout by faculty and trustees. The Institute has always had a few members interested in theoretical physics. This was inevitable in a school of which Einstein was a first member, and which Pauli and Bohr visited from time to time. But both the scope and the character of the work have changed. We have appointed two professors, Freeman Dyson and Abraham Pais; we have made arrangements for a continuing or recurrent association with the Institute for a number of physicists: N. Bohr, P. A. M. Dirac, Res Jost, G. Placzek, W. Pauli, L. Van Hove and C. N. Yang. The number of annual members has increased rapidly; in 1953, we had about 25 men in this field working at the Institute; and in the whole period, we have had about a hundred such members. Their work has eventuated in the publication of considerably over a hundred papers in the Physical Review and to a more limited extent in other technical journals.

The members in physics, that are selected by the physics faculty, come to us from many places, and in many different stages of their work. A few of the most brilliant post-doctoral students in the country come here for a year or two of further study; a few come to us on leave from assignments involving serious administrative duties with the government or with industrial laboratories, and have a chance both to complete work which they have wished to undertake, and to learn of the new things that are under development. Many are scientists from abroad. In fact, it is in physics that we first reestablished effective and continuing contact with the Japanese physicists. We have had extremely brilliant young Chinese, who have immigrated from China after the war. Men from India and Pakistan, and from almost every country of Western Europe come. Very often members in physics, as in other subjects, have the support of their own governments, or an agency of the United States Government, such as the National Science Foundation, or of fellowships given by American universities or foundations. [The work in physics is coherent, but not organized. We have had seminars of two kinds; one is a continuing seminar with meetings whenever the Institute is in session, on problems of current interest, on the work of members, or more rarely on work done elsewhere

which we need to hear and discuss at first hand. The other seminars will be devoted to a theme, usually one which is in need of critical review and analysis, and may continue for a month or a semester.

The principal subjects of work in theoretical physics at the Institute have had to do with the structure, nature, interactions, description and theory of the primordial particles of which matter is composed. But there has been much work of a methodological nature, and especially in quantum electrodynamics and in the so-called meson theory of nuclear forces. There has been work on ⁶classical nuclear physics, on statistical mechanics, on problems of order and disorder, condensation, the solid state and the strange phenomena of superconductivity and superfluid helium. In a few cases there has been extraordinarily fruitful collaboration between theoretical physics and pure mathematics; and among many members there is a substantial community of interest and knowledge between these two disciplines.

General

The varied work of the Institute is, of course, specialized.

No advanced study or deep scholarship can be other. We make no attempt and indeed can make no attempt to provide formal channels of liaison or what is unhappily called integration . There have been indeed some instances of unexpected and unpredicted collaboration as that between the French Dominican Father, Jean de Menasce, and the French mathematician, Benoit Mandelbrot, on the theory of languages. But it is not in such exceptions that the essential community is to be found. The members of the Institute are a community none the less. They are a community because many members have in effect ranging and wide interests, and some substantial knowledge outside their own field of specialization. They are a community because close friendships are inevitable which contribute to mutual understanding and common interest. The fact that most of the members of the Institute live in the same apartments, eat in the same restaurant, share the same common room and the same library helps to bring them together. The members of the Institute are of course also a part of the larger community of Princeton, with its university and its many institutions of research and learning.

We do from time to time have general lectures intended for all members and their guests, to give in not too technical terms an account of progress in one or another field.

Plant

There have been no radical changes in the Institute's physical plan in the years covered by this report. The Institute has grown, and in response to this growth, we have erected three modest buildings. They have had the triple function (a) of providing study and office space for the increased number of members, (b) of allowing the library to expand from its original confines to adjacent rooms in the main building, Fuld Hall, and (c) of providing rooms for consultation, conference and seminars. They have given us about sixty new offices and two new conference rooms, and have been arranged so that continued physical expansion will lead to an open, bell-shaped array of buildings with the opening facing south and Fuld Hall at its vertex. The cost of these buildings has been about \$400,000. The library itself has grown rapidly, from 24,000 to 40,000 volumes, though we still keep it as a working library, only adding volumes for which professors and members have recurrent and important use, but in no sense attempting completeness even in limited fields. We still depend decisively on access to the Firestone Library of Princeton University, to whose construction we contributed a half a million dollars, without which our problems of

adequate access to books would be almost unmanageable. We were fortunate to receive from Lessing Rosenwald, a trustee of the Institute, a collection of early editions of scientific texts. This is housed in a separate room of the library, and is much used by historians and scientists alike. To this we are adding in an orderly and modest way.

The only other items of addition to plant during these years are two: a shop and garage building for the maintenanceⁿ and storage for the Institute's equipment and transportation, and a sizeable addition to the building in which the electronic computer is housed, an addition which provides a permanent site for the computer itself, and additional office space for the scientists and coders who make use of the computer, for meteorological and other studies, or individuals who are contributing to its improvement and further development. There has been no addition to the housing available to the Institute for its contemporary members; and this constitutes a troublesome deficiency in our present plant.

Schools

In 1948, the academic life of the Institute was divided into three schools: a large and growing School of Mathematics, which included physics and was to include more and more of it; a relatively small School of Historical Studies, centered in, but not confined to archeology; and a School of Economics and Politics, with three professors of economics and one of modern history. This was soon to change. Professor Warren died; Professor Riefler resigned to reenter the Federal Reserve System; and Professor Stewart retired, which ultimately led to his serving on the President's Council of Economic Advisers. But even before these evidences had changed the complexion of the faculty, we had had serious consideration of the proper direction of the work of the Institute in fields other than mathematics and physics. We were persuaded that the Institute, limited in facilities for statistical and economical research, divorced from students and from current affairs, was probably not an ideal site for advanced work in economics on a continuing basis. It obviously is and has remained a desirable place for economic studies of limited duration.

We further became convinced that the unifying and ~~is~~ invigorating

element of work in history and the humanities must be the conscientious use of the historical method; and that a school devoted to this purpose would, in all its heterogeneity, be a proper complement and balance to the school devoted to mathematical analysis. Thus in the autumn of 1949, the academic work of the Institute was reorganized to correspond to two schools, a School of Historical Studies and a School of Mathematics (and Mathematical Physics?). We have found these themes broad enough to provide a framework for all the undertakings on which we wished to embark.

The School of Historical Studies was strengthened by three faculty appointments, that of Harold Cherniss in 1948, and that of Ernst Kantorowicz and Sir Llewellyn Woodward in 1952. Here we have made arrangements for the continuing or recurrent membership of the distinguished British historian, G. Veronica Wedgwood, of the historian of early mathematics, O. Neugebauer, and of the French Geographer, Jean Gottmann.

The work in modern history has prospered. Professor Earle has continued to hold his seminars, which were even in the early days at Columbia his special improvisation, one on the Dynamics of Soviet Policy, one on the Causes of the American Entry into the First World War, one on

the Decline of Liberalism as a Political Philosophy, and one on Modern France.

Professor Woodward has annually brought to us many of the most gifted British historians; and his own extraordinarily high standards for the writing of contemporary history has been to us both a guide and a restraint. In these ventures we have had about forty members in Modern History over these years; and many books and valuable publications.

Relations with Princeton University

Although the Institute has no administrative or organic connection with Princeton University, there has been very close collaboration in matters of common interest; and we have sought to take advantage of each ~~the~~ others facilities in the freest possible way. All Institute seminars are attended by those from the University who are interested, and the University seminars and conferences are frequently attended by Institute members. There are many cases of collaboration in research between the Institute and the faculty of the University. Several distinguished members of the Princeton faculty have elected to spend their sabbatical in residence at the Institute. We have had for some years a standing inter-faculty committee to consult on problems of common interest. We are, of course, vastly in debt to the University, without which this community would be both physically beyond and intellectually far less adequate for our own undertakings.

- Scope - growth
- Account - emphasis on change -
- Members - Schools - Faculties - Trustees -
S & M. ~~different style~~

I Pure Math

a) Morse

- #s, origin, publications

~~Publications~~

b) Physics Pais, Dyson, Placzek

- Summary of situation

c) applied math -

II

archeology

gk Philosophy

Neugebauer

Lowe -

EKA

Pan -

Modern History

Earle

Woodward

members

gerontology

III ~~the~~ breadth - Φ nuclear Fund - ; school system

IV a) Integration; b) rel. Primat

V Plant; Funds.

INSTITUTE FOR ADVANCED STUDY

Analysis of Operations and Income
1948-49 and 1952-53

	<u>1948-49</u>	<u>1952-53</u>
Total Expenditures - Including Institute, Gov't Contracts, Special Purpose Funds	\$835,000	\$1,200,000
Funds Provided From Outside Sources	<u>225,000</u>	<u>385,000</u>
Institute Funds	\$610,000	\$815,000

Minot C. Morgan, Jr.

February 26, 1954

Farmer, Paul. Work on: A study of the Vichy regime. (1954?)

Fox, Edward W. *Book on France - modern history - not yet published*
~~Has not replied; sending 2d notice (Mrs. Hartz might know)~~

Hughes, Henry S. Work on: Oswald Spengler; a critical estimate. N.Y., 1952.

Kennan, George.F. American diplomacy, 1900-1950. Chicago, 1951.

✓ Thomson, David. Work on: the government of the Fourth Republic. Pub.?
Work on: Two Franchmen: Pierre Laval and Charles de Gaulle.
London, 1951.

✓ Wright, Gordon. The French peasantry, 1919-1939. Pub.?

Palfrey, John. No reply

Craig, Gordon A. Work on (i.e. one chapter in) The diplomats, 1919-1939.
Princeton, 1953.

Work on (i.e. one chapter in) a projected book: The politics
of the Prussian Army.

De Rusett, Alan W. No reply; sending 2d notice.

Gatzke, Hans. Work on: Admiral Tirpitz and the ^{politics of the} German Navy. (1955?)

Postan, Michael. Cambridge economic history of Europe. vol.2. 1953.

✓ Graham, Gerald S. Work on a book on the expansion of British maritime
communications and commerce after 1815 and the relationship between
this imperial expansion and British sea power.

✓ Hancock, William K. Work on: Country and calling. (1954?)

✓ Medlicott, William N. Work on: The concept of Europe, 1879-1882. Unpub.

Nothing for 1953/54 as yet.

Earle, Edward M. Editor: Makers of modern France. Princeton, 1951.

Woodward, Sir L. Work on Documents on British Foreign Policy, 1919-1939.

Mitrany, David. Marx against the peasant. London & Chapel Hill (i.e. 2
different editions) 1951.

February 25, 1954

Edward M. Earle

Members of Institute

Academic year 1947-1948
through first term 1954-1955

Max Beloff	Nuffield College, Oxford (<u>first term, 1954-55</u>)
Asa Briggs	Worcester College, Oxford
Edward H. Buehrig	Indiana University
J. P. T. Bury	Corpus Christi College, Cambridge
Herbert H. Butterfield	Peterhouse, Cambridge
Edward H. Carr	Formerly of University College of Wales
Jean-Jacques Chevallier	Institut d'Études Politiques, University of Paris
Gilbert Chinard	Princeton University
William H. B. Court	University of Birmingham, England (<u>first term, 1954-55</u>)
Gordon A. Craig	Princeton University
? Alan W. de Russett	University of Leeds, England
Andreas Dorpalen	St. Lawrence University
Henry W. Ehrmann	University of Colorado
Paul Farmer	University of Wisconsin
Denna F. Fleming	Vanderbilt University
Edward W. Fox	Cornell University
Hans W. Gatzke	The Johns Hopkins University
Pieter Geyl	University of Utrecht, Netherlands
Jean Gottmann	Institut d'Études Politiques, University of Paris
Gerald S. Graham	King's College, University of London
Henry E. Guerlac	Cornell University
Sir Keith Hancock	Institute of Commonwealth Studies, University of London
H. Stuart Hughes	Stanford University (formerly Harvard University)
James Joll	St. Antony's College, Oxford

February 25, 1954

Edward M. Earle

	Hans Kohn	City College of New York (formerly Smith College)
?	Joseph Kraft	(Assistant to Professor Earle)
	Arthur S. Link	Northwestern University (<u>1954-1955</u>)
?	Francis L. Loewenheim	(Assistant to Professor Earle)
	William N. Medlicott	London School of Economics (formerly University College of the South West, Exeter, England)
	Michael M. Postan	Peterhouse, Cambridge
	Christopher Seton-Watson	Oriel College, Oxford
	B. Humphrey Sumner (deceased)	The Warden, All Souls College, Oxford
	Frank Thistlethwaite	St. John's College, Cambridge (<u>first term, 1954-55</u>)
	David Thomson	Sidney Sussex College, Cambridge
	Sir Charles K. Webster	London School of Economics
	C. Veronica Wedgwood	Time & Tide, London
	Gordon Wright	University of Oregon

Sir Llewellyn Woodward was a member before he became a Professor at the Institute.

February 25, 1954

Seminars Conducted by

Edward M. Earle

Academic year 1947-1948 to date

DYNAMICS OF SOVIET POLICY (Spring Term, 1947-1948)

CAUSES OF AMERICAN ENTRY INTO THE FIRST WORLD WAR (Autumn Term, 1948-1949)

DECLINE OF LIBERALISM AS A POLITICAL PHILOSOPHY (Autumn Term, 1949-1950)

MODERN FRANCE (Autumn Term, 1950-1951)

Conducted four-day (February 1-4, 1950) Conference on Modern France

<u>Member</u>	<u>PUBLICATION</u>	<u>DATE</u>
BARON, Hans	"The Crisis of Early Italian Renaissance"	1953?
BAYKOV, A. M.	"Soviet Foreign Trade"	1946
Cooper, J. C.	"The Right to Fly"	1947
Schiffer, Walter	"The Legal Community of Mankind" (in press) Book now in press on the Concept of Leagues (of Nations)	
Carr, E. H.	"The Bolshevik Revolution, 1917-23" (3 vols to appear in '52-53)	
	"German-Soviet Relations between the Two World Wars" 1951	
Leah Morris, R. B.	"Freedom and Labor in the Slave States" (to appear in 1955)	
Toynbee, Arnold	"Religio Historici"	
	"A Study of History" Vols. 7-11	
Beuchrig, E. H.		
Beuhrig, E. H.	"Our First European Intervention, 1917"	(to appear)
Coale, Ansley	"Measurement in Economics" (in progress)	
Ciriacy-Wantrup, S.	"Resource Conservation: Economics & Policies"	
Fleming, Denna F.	(has written 2 books; Miss Sachs is looking these up)	
Davis, Joseph-	"Consumption Economics" (to appear in '54?)	
Feis, Herbert	"The Road to Pearl Harbor,"	1950
	"The China Tangle"	1953
Gottman, Jean	"A Geography of Europe"	1950
	"La politique des Etats et leur geographie" Paris	1952
Marx, Danniel	"International Shipping Cartels"	1953
Robbins, Lionel	"The Theory of Economic Policy in English Classical Political Economy"	
Byrnes, R. F.	"Anti-Semitism in Modern France," Vol. II	1953?
	(The Drifus affair)	
	<i>(Member of Prof. Earle's seminar but not Institute)</i>	
Chevallier, J. J.	"Evolution des ideologies politiques depuis 1914 et influence de cette evolution sur les regimes constitutionnels et les relations internationales"	1953?
	"Histoire des idees politiques de Platon à nos jours"	

- Dyson, "Continuous Function Defined on Spheres"; 1951
 "The Dynamics of a Disordered Linear Chain"; 1953
- Brown, Laurie, "Grain Density in Nuclear Emulsions"; 1953
- Brueckner, Keith A. and Low, Francis, "Singular Potentials and the Theory of the Effective Range"; 1951
- Case, K. M., "Equivalence Theorems for Meson-Nucleon Couplings";
 "On Nucleon Moments and the Neutron-Electron Interaction";
- Case, K. M. and Pais, A., "On Spin-Orbit Interactions and Nucleon-Nucleon Scattering"; 1950
- Case, K. M., "Singular Potentials"; 1950
 "On High Energy Nucleon-Nucleon Scattering"; 5/16/50
- Christian, R. and Lee, T. D., "The Intermediate Coupling Method for Meson Nucleon Scattering"; 5/19/53
- Deser, S., Thirring, W. E., Goldberger, M. L., "Low Energy Limits and Renormalization in Meson Theory"; December, 1953
- Dyson, Freeman J., "The Dynamics of a Disordered Linear Chain"; typed 11/53
 "Heisenberg Operators in Quantum Electrodynamics. I"; PR 12/11/50
 "The Radiation Theories of Tomonaga, Schwinger and Feynman"; PR 10/6/48
 "The S-Matrix in Quantum Electrodynamics";
- Eckart, Carl, "The Generation of Wind Waves on a Water Surface"; PR 6/15/53
 "Relation between Time Averages and Ensemble Averages in the Statistical Dynamics of Continuous Media"; PR 4/2/53
 "The Scattering of Sound from the Sea Surface"; PR 1/5/53
 "The Theory of Noise in Continuous Media"; PR 11/25/52
 "The Theory of Steady Turbulence";
- Kac, M. and Ward, J. C., "A Combinatorial Solution of the Two-Dimensional Ising Model";
- Karplus, Robert and Kroll, Norman, "Fourth-Order Corrections in Quantum Electrodynamics and the Magnetic Moment of the Electron"; PR 2/15/50
- Karplus, Robert and Neuman, Maurice, "Non-Linear Interactions between Electromagnetic Fields"; PR 6/12/50
- Kinoshita, Toichiro and Nambu, Yoichiro, "The Collective Description of Many-Particle Systems (A Generalized Theory of Hartree Fields)";
- Lepore, Joseph V., "Polarization of Neutrons and Protons by Scattering"; PR 1/23/50
- Levy, Maurice M., "Meson Theory of Nuclear Forces and Low Energy Properties of the Neutron-Proton System"; PR 8/7/52
 "Non-Adiabatic Treatment of the Relativistic Two-Body Problem"; PR 6/2/
 "Notes on the pseudoscalar two-nucleons problem"
 "Notice sur les travaux scientifiques"; March, 1952
 "On the Relativistic Pseudoscalar Meson Theory of the Deuteron"; PR 6/29/
 "The Symmetrical Pseudoscalar Meson Theory of Nuclear Forces"; PR 4/18/52
- Lewis, H. W.; "Range Straggling of a Nonrelativistic Charged Particle"; PR 6/14/51
- Lewis, H. W., Oppenheimer, J. R., and Wouthyksen, S. A., "The Multiple Production of Mesons"; PR 10/2/47

INDEX

R. Jost, J. M. Luttinger & M. Slotnick

Distribution of Recoil Nucleus in
 Pair Production by Photons
 (Physical Review--10/15/50)

R. Jost and A. Pais

On the Scattering of a Particle by a
 Static Potential (Phys. Rev. 6/15/51)

R. Jost & Walter Kohn

Construction of a Potential from a
 Phase Shift (Phys Rev 9/15/52)

Jastrow, Robert

On the Nucleon-Nucleon Interaction
 (Phys Rev 1/15/51)

Jastrow, Robert

On Charge Independence & High Energy
 Scattering (Phys Rev 7/15/50)

Jastrow, Robert

Note on the Low-Energy Properties of
 the Nucleon-Nucleon Interaction
 (Phys Rev 8/1/53)

Herring, Conyers

Theory of Thermoelectric Power of Semi-
 Conductors (unpubl)

Herring, Conyers (Lectures-Notes by
 van Kampen & Ravenhall)

Ferromagnetism (unpubl; summer 1953)

Goldstein, J. S.

Properties of the Salpeter-Bethe Two-
 Nucleon Equation (Phys Rev 9/15/53)

Glauber, Roy J.

Some Notes on Multiple-Boson Processes
 (Phys Rev 11/1/51)

Glabuer, R. J.

On the Gauge Invariance of the Neutral
 Vector Meson Theory (unpubl& 1951)

Gell-Mann, Murray & Low, Francis

On Bound States in Quantum Field Theory

Fukuda, H.

Multiple Meson Production by High Energy
 Nucleon-Nucleon Collisions (Phys
 Rev 2/15/53)

Finkelstein, R. J.

On the Quantization of a Unitary Field
 Theory (Phys Rev 4/1/49)

Fierz, M.

Zur Theorie der Kondensation (Helvetica
 Physica Acta ~~21/5/51~~ 6/21/51) Vol24

Fierz, M. (discussed this with Heisenberg
 while here--credit notes)

Über die Bedeutung der Funktion D_c in der
 Quantentheorie der Wellenfelder
 (Helvetica Physica Acta 8/24/50) Vol27

Feldman, David

On Realistic Field Theories & the Polariza-
 tion of the Vacuum (11/1/49--Phys Rev

Hamilton, Donald R.; Aaron Lemonick
 & Francis M. Pipkin

Beta-Gamma Polarization Correlations
 (Phys Rev 12/1/53)

Lloyd, Stuart P., "The Angular Correlation of Two Successive Nuclear Radiations"; PR 11/12/51
 "Explicit y y Angular Correlations. II. Polarization Correlations"; PR 7/30/52

Lopes, J. Leite, "The Nucleon Magnetic Moment in Meson Pair Theories"; PR 11/30/49

Low, Francis, "Natural Line Shape"; PR 5/9/52

Low, F. E., and Salpeter, E. E., "On the Hyperfine Structure of Hydrogen and Deuterium"; PR 6/4/51

Luttinger, J. R., "A Note on Tisza's Theory of Superconductivity"; PR 4/24/50

Matthews, P. T., "Renormalization of Neutral Mesons in Three-Field Problems"; PR 10/27/51

✓ Matthews, P. T., and Salam, Abdus; "The Renormalization of Meson Theories"; RPH 10/51

Merzbacher, Eugen, "Note on Higher Order Effects in Beta-Decay"; PR; 11/16/50
 (summary of PH.D thesis submitted through IAS)

Messiah, Albert M. L., "Scattering of Slow Neutrons by H_2 and CH_4 "; PR 4/5/51
 "Sur la Diffusion des Neutrons - Lents - Par L'Oscillateur Harmonique Isotrope"; Tome 6/12/51

Michel, L., "u-meson Decay, B-radioactivity and Universal Fermi Interaction"; typell/51

Placzek, G., "The Scattering of Neutrons by Systems of Heavy Nuclei"; PR 12/20/51

Placzek, G. and Van Hove, L., "Crystal Dynamics and Inelastic Scattering of Neutrons"; typed 12/53

Placzek, G., Nijboer, B. R. A. and Van Hove, L., "Effect of Short Wavelength Interference on Neutron Scattering by Dense Systems of Heavy Nuclei"; PR 10/13/50

Power, S., "Decay of a Heavy t-meson into Three Lighter Mesons"; typed

Price, P. J., "The Macroscopic Theory of Superfluid He^3 - He^4 Mixtures"; PR 11/28/52

Racah, Giulio, "Directional Correlation of Successive Nuclear Radiations"; PR 8/6/51

Merzbacher, Eugen and Park, David, "Group Theory and Spectroscopy by Giulio Racah"; Notes by EM and DP; spring, 1951

✓ Roberts, K. V., "Papers on Strong-coupling Theory and Related Topics"; typed 2/52

Salam, Abdus, "Divergent Integrals in Renormalizable Field Theories"; PR 6/22/51

✓ "Renormalized S-Matrix for Scalar Electrodynamics"; PR 2/16/51 6/1/52

Steinberger, J., "On the Range of the Electrons in Meson Decay"; PR 1/10/49

"On the Use of Subtraction Fields and the Lifetimes of Some Types of Meson Decay"; PR, 10/15/49

Tomonaga, S., "Remarks on Bloch's Method of Sound Waves Applied to Many - Fermion Problems"; typed

Van Hove, L. C., "Temperature Variation of the Magnetic Inelastic Scattering of Slow Neutrons", letter, PR, September, 1953

Van Hove, L and Marshak, R, and Pais, A, "Charge Independence and Multiple Pion Production"; PR 10/9/52

Placzek, G.

Incoherent Neutron Scattering by Polycrystals (to appear Phys Rev)

Pauli, W. & ~~Frank~~ Hu, N.

On the Strong Coupling Case for Spin-Dependent Interactions in Scalar- & Vector-Pair Theories (Rev Mod Phys Apr-July 1954 1945)

Pauli, W. -- Letter to Schwinger dated 1/24/49

Pauli, W.

Niels Bohr on His 60th Birthday (Rev Mod Phys Apr-Jul 45)

Pauli, W.

On Applications of the Lambda-Limiting Process to the Theory of the Meson Field (Phys Rev--12/1 & 12/15/43)

Pais, A. & Uhlenbeck, G. E.

On Field Theories with Non-Localized Action (Phys Rev 7/1/50)

Pais, A. & Jost, R.

Selection Rules Imposed by Charge Conjugation & Charge Symmetry (Phys Rev 9/1/52)

Pais, A. & Epstein, S. T.

Note on Relativistic Properties of Self-Energies (Rev Mod Phys July 1949)

Pais, A.

Some Remarks on the V-Particles (Phys Rev 6/1/52)

Pais, A.

POSITRON THEORY

Pais, A.

Isotopic Spin & Mass Quantization (Physica XX--Lorentz Kamerlingh Onnes Conf) '53

Nijboer, BRA & van Hove, L.

Radial Distribution Function of a Gas of Hard Spheres & the Superposition Approximation (Phys Rev 3/1/52)

Nambu, Y. Analysis of the Gamma-Pi⁺ Production (data observed at Cal Tech, summer '53 & written at IAS)

Morette, Cecile

On the Production of Pi-Mesons by Nucleon-Nucleon Collisions (Phys Rev 11/15/49)

Morette, Cecile

On the Definition & Approximation of Feynman's Path Integrals (Phys Rev 3/1/51)

Kinoshita, T.

V-Particles & the Gamma-Decay of a Neutral Pion

Kinoshita, T.

Effect of Coulomb Barrier on the Meson Production by Nucleon-Nucleus Collision

- Van Hove, Leon, "The Occurrence of Singularities in the Elastic Frequency Distribution of a Crystal"; PR, 12/5/52
- Van Kampen, N. G., "S-Matrix and Causality Condition. I. Maxwell Field"; PR 10/22/52
"S Matrix and Causality Condition. II. Nonrelativistic Particles"; PR 5/20/53
- Villars, F., "On the Energy-Momentum Tensor of the Electron"; PR, 3/8/50
- Ward, J. C., "Renormalization Theory of the Interactions of Nucleons, Mesons, and Photons"; PR, 12/1/51
- Watson, K. M. and Lepore, J. V., "Radiative Corrections to Nuclear Forces in the Pseudoscalar Meson Theory"; PR 6/13/49
- Wick, G. C., "The Scattering of Neutrons by Systems Containing Light Nuclei"; typed, 12/53
- ~~Wightman, S. and others, 1952~~
- Yang, CH, "Letter from C. N. Yang to E. Fermi (May 5, 1952)"
- Yang, CH, "Letter from Yang on Chicago Experiment", 4/16/52
"Possible Experimental Determination of Whether the Neutral Meson is Scalar or Pseudoscalar"; typed
"The Spontaneous Magnetization of a Two-Dimensional Ising Model"; PR, 3/1/52
- Yang, C. N. and Beldman, David, "The S Matrix in the Heisenberg Representation" type
- Yang, C. N. and Lee, T. D., "Statistical Theory of Equations of State and Phase Transitions I. Theory of Condensation"; ~~typed, 1952~~
PR, 8/1/52
- Lee, T. D. and Yang, C. N., "Statistical Theory of Equations of State and Phase Transitions. II. Lattice Gas and Ising Model"; PR 8/1/52
- Yang, C. N. and Tiomno, J., "Reflection Properties of Spin 1/2 Fields and a Universal Fermi-Type Interaction"; PR 8/1/50
- Yennie, D. R., "Angular Momentum in Nonlocal Field Theory", PR 10/1/51 (IAS?)
"Quantum Corrections to Classical Nonlinear Meson Theory"; PR 7/8/52
- Yukawa, Hideki, "Models and Methods in the Meson Theory"; RMP, July, 1949 (IAS?)
"On the Radius of the Elementary Particle"; PR 6/2/49

Members for Professors Thompson, Goldman and Meritt: 1948-53.

Professor Goldman has been retired most of this time. The members, in addition to our assistants, have varied in number per year from four to ten--giving an average of $6\frac{1}{2}$ --and over the years two of these members have been Miss Goldman's and the rest are Thompson and Meritt's. This covers the last six years.

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

March 1, 1954

Dear Robert:

This is the promised writeup. It amounts to about 1000 words, but there is nothing in it — I hope — which omission would not cure.



John von Neumann

Encl.

Dr. Robert Oppenheimer
Institute for Advanced Study
Princeton, N. J.

THE INSTITUTE FOR ADVANCED STUDY
SCHOOL OF HUMANISTIC STUDIES
PRINCETON, NEW JERSEY

March 1, 1954

Dear Robert,

I have written the part on Ancient Philosophy as well as I could with the notion that it is to fit into a consecutive account of the School of Historical Studies. For that reason I have made the paragraph on Neugebauer and his associates follow this section immediately. It seems to me that the few sentences about Lowe and the people who have worked with him might reasonably follow this. I would suggest that with appropriate transitions the whole account of the School be put together in this order: Archaeology etc., Greek Philosophy and Science (with Neugebauer and Lowe following), Mediaeval History (Eka and his associates), History of Art (Pan and his associates, since they deal mainly with Mediaeval and Renaissance art etc.), Modern History. May I suggest that after this you add a paragraph pointing out the increased integration that the School has achieved during your Directorship? The order of the account itself will, I think, point to this integration; but it should be observed that the consolidation of the two Schools contributed to this effect, and here I should think that you could properly indicate the way in which your use of the Director's fund served both to strengthen the integration of the School and to help bridge the gap between it and the School of Mathematics. In illustration of the latter Neugebauer's activities can well be cited as well as the appointment of psychologists and others; in evidence of the former there are the literary people, e.g. Francis, Auerbach, Linforth, Perry Miller, the people in political history like Kennan and Feis, Jean Gottman in geography, and Morton White in philosophy, whose presence I have found particularly pleasant and helpful. The School has certainly been greatly strengthened and enriched by the initiative that you have taken in these matters, and I trust that you will not refrain from making this point perfectly clear - however tactfully you choose to do it.

Yours,

Harold.

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

February 24, 1954

Dear Colleagues:

Dr. Oppenheimer proposes that there be written a very small pamphlet describing the major appointments to the Institute of the last six years, together with the trends, emphasis and orientation. He has asked me to draw up a preliminary rough draft for mathematics outside the computing laboratory.

It will help if you give me, in two or three lines, what has been your main interest in these years and what you plan to emphasize in the coming years.

A statement as to what you think the Institute as a whole is emphasizing would be useful in its relation to world mathematics.

All this should be very brief. I would like it as soon as possible. The language should be as non-technical as possible.

Sincerely yours,

W. Morse
Marston Morse

Professors ☒ Godel
 ☒ Montgomery
 ☒ Selberg
 ☒ von Neumann
 ☒ Whitney

My main interests in the last six years have been:

- 1. The cosmological problem on the basis of general relativity theory*
- 2. Relationships between modern logic & philosophy*

In the coming years I plan to emphasize item 2.

DIRECTOR'S FUND

2 list

1948-49

Burke, Kenneth
 Fergusson, Francis
 Radin, Max

Andover, N. J.
 (now at Rutgers University)
 University of California

H/S) literary criticism
 H/S)
 H/S Law

1949-50

Auerbach, Erich
 Curtius, E. R.
 Leake, Chauncey D.
 Radin, Max

Pennsylvania State College
 Bonn University
 University of Texas
 University of California

H/S Romance languages
 H/S Med. Lit. /& literatures
 H/S Medical papyri
 H/S Law

st Georgi

1950-51

Chakravarty, Amiya
 Kennan, George F.
 Palfrey, John G.

Balliol College, Oxford
 Department of State
 Columbia University (AEC)

H/S
 H/S
 H/S

1951-52

Bruner, Jerome S.
 Leake, Chauncey D.
 Levy, David M.
 Menasce, de, Father Jean
 Palfrey, John G.
 Tolman, Edward C.

Harvard University
 University of Texas
 New York, N. Y.
 Ecole des Hautes Etudes
 Columbia University
 University of California (here for 3 weeks only)

Math Psychology
 H/S Medical papyri
 Math Psychiatry
 H/S
 H/S

1952-53

Levy, David M.

New York, N. Y.

Math Psychiatry

1953-54

de Menasce
 Berlin, Isaiah
 Leake, Chauncey D.
 Miller, Perry
 White, Morton
 Wald, George
 Kennan, George F.

All Souls College, Oxford
 University of Texas
 Harvard University
 " "
 " "

H/S Literary criticism
 H/S Medical papyri
 H/S Philosophy-history of
 H/S Philosophy ideas
 Math Biology
 H/S

1954-55

Berlin, Isaiah
 Kennan, George F.
 Piaget, Jean
 Wallach, Hans

All Souls College, Oxford
 University of Geneva
 Swarthmore College

H/S Literary criticism
 H/S
 Math Psychology
 Math Psychology

DIRECTOR'S FUND

Special Seminars, Conferences, etc.

1949-50

Psychology Conference	23-27 November 1949	Research into Psychological Problems--methodology
Legal Conference	10-12 February 1950	(Security & Policy formation)
Legal Conference (Gen. Greenbaum)	12-13 May 1950	(Administration of justice)

1953-54

Acheson Seminars

Review of US Foreign Policy

DIRECTOR'S FUND

1948-49

Burke, Kenneth	Andover, N. J.	H/S) literary criticism
Fergusson, Francis	(now at Rutgers University)	H/S)
Radin, Max	University of California	H/S Law

1949-50

Auerbach, Erich	Pennsylvania State College	H/S Romance languages
Curtius, E. R.	Bonn University	H/S Med. Lit. /& literature
Leake, Chauncey D.	University of Texas	H/S Medical papyri
Radin, Max	University of California	H/S Law

1950-51

Chakravarty, Aniya	Balliol College, Oxford	H/S
Kennan, George F.	Department of State	H/S
Palfrey, John G.	Columbia University (AEC)	H/S

1951-52

Bruner, Jerome S.	Harvard University	Math Psychology
Leake, Chauncey D.	University of Texas	H/S Medical papyri
Levy, David M.	New York, N. Y.	Math Psychiatry
Menasce, de, Father Jean	Ecole des Hautes Etudes	H/S
Palfrey, John G.	Columbia University	H/S
Tolman, Edward C.	University of California (here for 3 weeks only)	

1952-53

Levy, David M.	New York, N. Y.	Math Psychiatry
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1953-54

Berlin, Isaiah	All Souls College, Oxford	H/S Literary criticism
Leake, Chauncey D.	University of Texas	H/S Medical papyri
Miller, Perry	Harvard University	H/S Philosophy-history of
White, Morton	" "	H/S Philosophy idea
Wald, George	" "	Math Biology
Kennan, George F.		H/S

1954-55

Berlin, Isaiah	All Souls College, Oxford	H/S Literary criticism
Kennan, George F.		H/S
Piaget, Jean	University of Geneva	Math Psychology
Wallach, Hans	Swarthmore College	Math Psychology

DIRECTOR'S FUND

Special Seminars, Conferences, etc.

1949-50

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Legal Conference 10-12 February 1950

Legal Conference (Gen. Greenbaum) 12-13 May 1950

Research into Psychological
Problems--methodology
(Security & Policy forma-
tion)
(Administration of justice)

1953-54

Acheson Seminars

Review of US Foreign Policy

1953-54

PHYSICISTS IN RESIDENCE AT THE INSTITUTE

Dyson, Freeman J.
Pais, Abraham
Placzek, George
~~Weyl, Hermann~~
Yang, Chen Ning (Brookhaven this year)

Coester, Fritz
Deser, Stanley
Eden, Richard J.
Havas, Peter
Jost, Res W.
Källén, A. O. G.
Kinoshita, Toichiro
Kobiyasi, Minoru (unarrived so far)
Michel, Louis
Nambu, Yoichiro
Newton, Roger
Pauli, Wolfgang
Siegert, Arnold J. F.
Thirring, Walter
van Hove, Léon C. P.
Miyazima, Tatsuoki
Garding, Lars

Mike

-0-

Bohr, Niels

Jacobsohn, Boris
Pirenne, Jeanne

VISITORS IN PHYSICS - 1947 to date

Bardeen, John	Oct 1950= 51	Bell Laboratories
Bradt, H? L?	Nov 1949	
Heisenberg, Werner	Oct 1950	
S. R. de Groot	Oct 1951	
Feynman, Richard P.	Nov 1949	
Froehlich, Hans	Feb 1950	
Gluckstern, G. L.	Apr 1950	
Hill, David L.	Apr 1950	
Kohn, Walter (6 wks)	Feb-Mar 1952	
Kotani, M.	Oct 1951	
Møller, C.	Dec 1948	
Salpeter, E.	Feb 1951	
Schwinger, Julian	Apr 1952	
Ter Haar, D. J.	Feb 1950	
Tisza, L.	Apr 1950	
Welton, T. A.	Mar 1949	
Wentzel, Gregor	Mar 1950	
Temperley, H. N. V.	Jan-Feb 1953	
Prigogine, I.	Mar 1953	
Klein, Abraham	Feb 1953	
Salpeter, E.	Oct 1952	
LePrince-Ringuet, L.	Feb 1954	
Levy, Maurice	Feb 1954	
Luttinger, J. M.	Jan 1954	
Dallitz, R. H.	Feb 1954	
Cooper, L. N.	Feb 1954	