



THE INSTITUTE FOR ADVANCED STUDY

(Founded by LOUIS BAMBERGER  
and MRS. FELIX FULD)

REPORT OF THE DIRECTOR

1948-1953

THE INSTITUTE FOR ADVANCED STUDY

Princeton, New Jersey

1954

*Extract from the letter addressed by  
the Founders to their Trustees, dated  
Newark, New Jersey, June 6, 1930*

"It is fundamental in our purpose, and our express desire, that in the appointments to the staff and faculty, as well as in the admission of workers and students, no account shall be taken, directly or indirectly, of race, religion, or sex. We feel strongly that the spirit characteristic of America at its noblest, above all, the pursuit of higher learning, cannot admit of any conditions as to personnel other than those designed to promote the objects for which this institution is established, and particularly with no regard whatever to accidents of race, creed, or sex."

## CONTENTS

	PAGE
REPORT OF THE DIRECTOR .....	1
BOARD OF TRUSTEES .....	30
PROFESSORS AND MEMBERS WITH APPOINTMENTS OF LONG TERM .....	31
MEMBERS LIST—	
FIRST TERM—SEPTEMBER 28, 1953-DECEMBER 18, 1953	32
SECOND TERM—JANUARY 11, 1954-APRIL 9, 1954....	35
FINANCIAL REPORTS .....	40

## REPORT 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 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 content and achievement.

*Nature of Institute's Activities  
and Faculties of Its Two Schools*

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 Heins 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.

*Its 300 Mathematician Members  
Have Published 500 Papers*

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 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 through-

out 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 Beurling, 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 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 Upsala. 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.

*Growth of Institute's Work  
in 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 since 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.

### *Some Examples of Achievements of the Institute's Physicists*

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 struc-

ture 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 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.

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. Pomerene and John von Neumann, together with a staff of electrical engineers.

#### *Meteorology Project Employs Computer as Research Tool*

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 suc-

cessively 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.

*Institute's Weather Research  
Elicits Wide Cooperation*

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 Meteorological 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, R. Fjörtoft 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.

*Combined Resources Yield Rich Results  
in Greek Archaeology and History*

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.

*Many Members Studying  
History of Ancient Athens*

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.

*Important Studies Being Conducted  
in 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.

*Brilliant Advances Made in Knowledge  
of Ancient Astronomy and Latin Paleography*

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".

*Paleography*

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 paleography, the *Codices Latini Antiquiores*, the sixth volume of which appeared in 1953. Other members have worked with Lowe on special problems in Latin paleography 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 Studies Have Yielded  
New and Significant Information*

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 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.

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 theo-

logical 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.

*Research in History of Art  
Varied and Strongly Individualized*

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 (Pro-



fessor 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 Weitzmann (Princeton, 1947, 1948, 1951); 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 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).

#### *Work in Modern History Has Prospered and Been Strengthened*

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



## THE SCHOOLS AND THE DIRECTOR'S FUND

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 returned to England each year during the long vacation of the Institute.

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.

*How Director's Fund  
Provides Flexibility*

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 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 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.

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

\* 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.

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 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.

*Institute's Physical Plant  
Grows in Response to Needs*

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, 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 J. 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 also 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 sizable 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; it supports many sepa-

rate fields of study; 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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AS AT JUNE 30, 1953

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Cash		\$362,754.96
Investments:		
Marketable securities at cost:		
Bonds	\$11,388,150.50	
Preferred stocks	420,079.46	
Common stocks	6,595,895.02	
	<hr/>	
(Market quotations \$22,- 377,009.16)	18,404,124.98	
Mortgages receivable	97,405.68	
	<hr/>	
Total investments		18,501,530.66
Accrued income and sundry receivables		114,315.94
Land, buildings, equipment and libraries—net		1,960,358.91
Electronic computer projects		971,175.61
Deferred Charges		13,226.17
		<hr/>
		<u>\$21,923,362.25</u>

LIABILITIES AND FUND BALANCES

Accounts payable and accrued expenses, etc.	\$	31,711.37
Appropriations, contributions and specific pur- pose funds, and other obligations		1,320,764.75
		<hr/>
Total liabilities and specific purpose funds		1,352,476.12
General Funds and Surplus		20,570,886.13
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		<u>\$21,923,362.25</u>

THE INSTITUTE FOR ADVANCED STUDY

LOUIS BAMBERGER AND MRS. FELIX FULD  
FOUNDATION

STATEMENT OF INCOME AND EXPENSES  
FOR THE YEAR ENDED JUNE 30, 1953

Income from investments, etc.	\$815,745.10	
Appropriations and Grants from out- side sources to be applied against current expenses below		177,711.59
		<hr/>
Total receipts		\$ 993,456.69
Expenses:		
School of Mathematics and Physics	\$448,764.68	
School of Historical Studies	282,568.33	
Salaries, administration and main- tenance	288,020.26	
	<hr/>	
Total expenses		1,019,353.27
Excess of expenses over income		<u>\$ 25,896.58</u>