THE INSTITUTE FOR ADVANCED STUDY

Founded by Mr. Louis Bamberger and Mrs. Felix Fuld

BULLETIN NO. 12

1945-1946

THE INSTITUTE FOR ADVANCED STUDY
Princeton, New Jersey
October, 1946

TABLE OF CONTENTS

STAFF OF THE INSTITUTE

FRANK AYDELOTTE, *Director*
ABRAHAM FLEXNER, *Director Emeritus*
JUDITH E. SACHS, *Librarian*

SCHOOL OF MATHEMATICS

Professors

JAMES WADDELL ALEXANDER
ALBERT EINSTEIN (*Emeritus*)
MARSTON MORSE
WOLFGANG PAULI (*Visiting Professor*)
CARL L. SIEGEL
OSWALD VEBLEN (*Emeritus*)
JOHN VON NEUMANN
HERMANN WEYL

Associate

WALTHER MAYER

Assistants

RICHARD F. ARENS
PESI MASANI
IRVING E. SEGAL
ERNST G. STRAUS
HSIO-FU TUAN

SCHOOL OF ECONOMICS AND POLITICS

Professors

EDWARD MEAD EARLE
WINFIELD W. RIEFLER
WALTER W. STEWART
ROBERT B. WARREN

SCHOOL OF HUMANISTIC STUDIES

Professors

HETTY GOLDMAN
ERNST HERZFELD (*Emeritus*)
E. A. LOWE (*Emeritus*)
*BENJAMIN D. MERITT
ERWIN PANOFSKY

Field Mediaevalist

KURT WEITZMANN

Research Assistant

HANNS SWARZENSKI

Assistants

STEPHANIE M. JAKIMOWITZ
FRANCES FOLLIN JONES
JUDITH E. SACHS

GEST ORIENTAL LIBRARY

Curator

NANCY LEE SWANN (*Emeritus*)

STANDING COMMITTEE: Professors Morse, Panofsky, Riefler
LIBRARY COMMITTEE: Professors Weyl, Warren, Goldman
SECRETARY OF FACULTY: Professor Goldman

* Absent on leave, 1945-1946.

The Institute for Advanced Study partakes of the character both of a university and of a research foundation. It is an institution in which a small permanent group of professors serves as the nucleus of a larger, temporary group of mature, though generally younger scholars. It has been found that the scholars thus brought together are so much interested in their respective tasks, in their own development and in the advancement of knowledge, that the usual academic arrangements such as regular courses, required attendance, degrees, examinations and administrative supervision can be dispensed with as superfluous.

In these respects, which are all consequences of the fact that it limits its membership to scholars of a high level of maturity, the Institute differs from all American universities. It is like a university in that its success depends on the influence that it exerts on its temporary members as well as on the individual discoveries of its professors. While it is like a research institute in that the members of its staff are contributors to knowledge, it differs in two major respects, (1) the emphasis on the stream of temporary members which flows through it, and (2) the absence of a specified program of research and of all regimentation.

In regard to appointments to the faculty and to membership in the Institute, the Founders in their letter addressed to their Trustees, dated Newark, New Jersey, June 6, 1930, have expressed the following wish: "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."

Applications for admission should be addressed to the Institute for Advanced Study, Princeton, New Jersey. The Trustees have set aside a sum which may be used for stipends for persons of distinct ability and promise who require a limited amount of financial aid.

CALENDAR

1945-1946
First term: September 17—December 15
Second term : February 4—May 4

1946-1947
First term: September 16—December 14
Second term : February 2—May 3

viii

PERMANENT MEMBERS

KURT GÖDEL, Ph.D., University of Vienna, 1930
DAVID MITRANY, Ph.D., London School of Economics and Politics

MEMBERS, 1945-1946

WILLIAM O. AYDELOTTE, Ph.D., Cambridge, 1934; Hodder Fellow and Lecturer in History at Princeton University, 1945-1946

VALENTINE BARGMANN, Ph.D., University of Zürich, 1936

HANS BARON, Ph.D., University of Berlin, 1922; Guggenheim Fellow

ALEXANDER BAYKOV, Ph.D., University of Birmingham, 1942; Senior lecturer, University of Birmingham on Faculty of Commerce and Social Studies

OTTO BENESCH, Dr. Phil., University of Vienna, 1921; Research Fellow of the Fogg Museum of Art, Harvard University; Guggenheim Fellow

RICHARD P. BLACKMUR, Lecturer in Humanities, Princeton University

SALOMON BOCHNER, Ph.D., University of Berlin, 1921; Associate Professor of Mathematics, Princeton University

NORMAN S. BUCHANAN, Ph.D., Cornell University, 1931; Professor of Economics, University of California at Berkeley

CHENG SHU WANG CHANG (Mrs. W. Y. Chang), Ph.D., University of Michigan, 1945; Rackham Fellow of the University of Michigan, 1945-1946

SHIING-SHEN CHERN, D.Sc., University of Hamburg, 1936; Professor of Mathematics, National Tsing Hua University

KEI-WON CHUNG, Ph.D., Princeton University, 1938

ix

PAUL A. CLEMENT, Ph.D., Johns Hopkins University, 1930

JOHN C. COOPER, A.B., Princeton University, 1909; Member of the Bar of the Supreme Court of the United States

EDWARD M. CORSON, Ph.D., Johns Hopkins University, 1945; Physicist in charge of Theoretical Division, Union Carbide and Carbon Company

CHARLES DE TOLNAY, Ph.D., University of Vienna, 1925

NELSON DUNFORD, Ph.D., Brown University, 1936; Professor, Yale University

J. J. L. DUYVENDAK, Ph.D., University of Leyden, 1928; Professor of Chinese, University of Leyden, The Netherlands

KY FAN, Dr. of Mathematical Sciences, University of Paris, 1941

GEORGE H. FORSYTH, JR., M.F.A., Princeton University, 1927

PAUL FRANKL, Ph.D., University of Munich, 1910

E. A. GOLDENWEISER, Ph.D., Cornell University, 1907

VIRGINIA R. GRACE, Ph.D., Bryn Mawr, 1934

NOEL HALL, A.M., Princeton University, 1926; M.A., Oxon.

PAUL R. HALMOS, Ph.D., University of Illinois, 1938; Assistant Professor, University of Chicago

MAXIMILIAN J. HERZBERGER, Ph.D., University of Berlin, 1923; on scientific staff of Eastman Kodak Company Research Laboratory

EDWIN HEWITT, Ph.D., Harvard University, 1942; Guggenheim Fellow, 1945-1946

NING HU, Ph.D., California Institute of Technology, 1944; Fellow of National Tsing Hua University

LESLIE W. JONES, Ph.D., Harvard University, 1925; Associate Professor of Classics, College of the City of New York

JOHN L. KELLEY, Ph.D., University of Virginia, 1940; Assistant Professor of Mathematics, University of Chicago

JOHN HARVEY KENT, Ph.D., University of Chicago, 1943; Associate Professor of Latin, Southwestern at Memphis

GEORGE L. KREEZER, Ph.D., Cornell University, 1928; Staff member, Massachusetts Institute of Technology Radiation Laboratory and Assistant Professor, Cornell University; Guggenheim Fellow

ALICE AMBROSE LAZEROWITZ, Ph.D., University of Wisconsin, 1932; Ph.D., University of Cambridge, 1938; Associate Professor of Philosophy, Smith College

RENSSELAER W. LEE, Ph.D., Princeton University, 1926; Professor of History of Art, Smith College

CLARENCE D. LONG, JR., Ph.D., Princeton University, 1938; National Bureau of Economic Research; Guggenheim Fellow

ALEXANDER LOVEDAY, M.A., Cantab.; Fellow of Nuffield College, Oxford

FRIEDRICH LUTZ, Dr. rer. pol., University of Tübingen, 1925; Associate Professor, Princeton University

SHIH-TSUN MA, Ph.D., University of Cambridge, 1941; Professor of Physics, National University of Peking

PESI MASANI, Ph.D., Harvard University, 1946

DEANE MONTGOMERY, Ph.D., University of Iowa, 1933; Professor of Mathematics, Smith College

FRANCIS J. MURRAY, Ph.D., Columbia University, 1935; Associate Professor of Mathematics, Columbia University

OTTO E. NEUGEBAUER, Ph.D., University of Göttingen, 1926; LL.D., St. Andrews University, 1938; Professor of Mathematics, Brown University

GORDON N. PATTERSON, Ph.D., University of Toronto, 1935; Officer in charge of Aerodynamics Section, Australian Council for Scientific and Industrial Research

A. EVERETT PITCHER, Ph.D., Harvard University, 1935; Assistant Professor of Mathematics, Lehigh University

W. KENDRICK PRITCHETT, Ph.D., Johns Hopkins University, 1942; Instructor, American School of Classical Studies at Athens

ABRAHAM J. SACHS, Ph.D., Johns Hopkins University, 1940; Research Associate, Brown University

ROBERT SCHATTEN, Ph.D., Columbia University, 1942; National Research Council Fellow, 1944-1946

WALTER SCHIFFER, Dr. jur., University of Breslau, 1929; Docteur ès sciences politiques, University of Geneva, 1937; Guggenheim Fellow

BERTA SEGALL, Ph.D., University of Vienna, 1928; AAUW Fellow, 1944-1945

RICHARD STONE, M.A., Cambridge, 1937; Director, Department of Applied Economics, Cambridge University; Fellow, King's College

FEODORA S. STONE, B.A., London University, 1934; Secretary, National Institute of Economic and Social Research, London

FEODOR THEILHEIMER, Ph.D., University of Berlin, 1936; Instructor in Mathematics, Trinity College

WILLIAM R. TRANSUE, Ph.D., Lehigh University, 1936; Associate Professor of Mathematics, Kenyon College

WILLIAM P. WALLACE, Ph.D., Johns Hopkins University, 1936; Associate Professor of Classics and Ancient History, University of Colorado

LUCIUS WILMERDING, JR., M.A., Oxford, 1929

TUNG YIU, M.A., Oxford, 1942; Professor, National Northwestern Union University, China; Fellow in Oriental Languages and Literatures, Princeton University

LEO ZIPPIN, Ph.D., University of Pennsylvania, 1929; Assistant Professor of Mathematics, Queens College, New York

Members of the Economic, Financial and Transit Department of the League of Nations on mission at the Institute for Advanced Study.

ALEXANDER LOVEDAY, *Director*	Great Britain
JOHN H. CHAPMAN	New Zealand
PAUL DEPERON	Belgium
FOLKE HILGERDT	Sweden
W. MARTIN HILL	Eire
MIROSLAV A. KRIZ (left the service in June 1945)	
	Czechoslovakia
JOHN LINDBERG	Sweden
CONSTANTINE F. MACGUIRE	Eire
RAGNAR NURKSE	Estonia
J. ANSGAR E. ROSENBORG	Sweden
PHYLLIS W. VAN ITTERSUM	Netherlands
PERCY GILL WATTERSON	Great Britain

Locally engaged Associates

SHAN K. FONG

ALFRED LANDAU

GERTRUDE H. LOVASY

SINCE our last Bulletin was published in March 1945, the Institute for Advanced Study has returned to a peace-time basis. Indeed during the past year research has been carried on in all three Schools with rather more than pre-war intensity. We have had the pleasure of welcoming to membership a number of men just released from the armed services or from war research projects, who have been able to secure a longer or shorter period of free time for research before returning to their regular academic work. Such an interval in the transfer from war to peace is highly useful to a young scholar for bringing himself up to date in his special field of study and for resuming original work before he becomes immersed in the busy routine of teaching. Unbroken leisure is needed for planning new projects and breaking new ground. It should then be possible for a man to make use of such time as he has free from teaching to carry on work so planned and begun.

During the academic year 1945-1946 the total number of scholars working at the Institute, faculty, members and assistants, rose to 92 and the prospects are that this total will be still larger in the year 1946-1947. During the last two years four members of the original faculty of the Institute and the Curator of the Gest Oriental Library have retired (in accordance with our sixty-five year rule) and have

been designated as Emeritus. These are Professors Einstein, Herzfeld, Veblen and Lowe and Miss Swann. In every case this retirement is merely technical. All four of the members of the faculty are continuing their scholarly work and their activities are duly recorded in the chapters devoted to the appropriate School. Miss Swann will continue for the time being her oversight of the Gest collection. David Mitrany who has been on leave in England since 1939 has resigned his professorship in the School of Economics and Politics in order to leave himself free to continue for the present the work which he is doing in England. Professor Mitrany has been elected to permanent membership in the Institute and we hope, as does he, that he will be able to come into residence for a few weeks each year and that he will eventually return to Princeton for an extended period of research.

Two new appointments have been made to the Faculty during the past year: Wolfgang Pauli in theoretical physics and Carl L. Siegel in mathematics. Kurt Gödel has been elected to permanent membership. Benjamin D. Meritt was granted leave of absence for the year 1945-1946 in order to serve as Eastman Professor at the University of Oxford, and the Director was given leave from January to April, 1946 to serve as a member of the Joint Anglo-American Committee of Inquiry on Palestine. Miss Goldman has been granted leave of absence for the year 1946-1947 to conduct field work in archaeology at Tarsus.

The members of the Economic Section of the League of Nations who have been in residence at the Institute since 1940 have now been appointed to the United Nations and transferred to the headquarters on Long Island. The members of this group were invited to Princeton in the dark days of 1940 when it looked as if the German armies might possibly invade Switzerland and when it seemed quite certain in any case that the war would seriously cripple their work in Geneva. Our purpose was to preserve the group intact in order that they might eventually be taken over by whatever international organization succeeded the League of Nations after the war, thus saving for the new organization the immense store of technical knowledge and experience gathered by these experts in twenty years of work for the League.

It was by no means certain in 1940 that the Allies would win the war. No one could be sure at that time whether the League of Nations would survive or whether any similar international organization would be formed to replace it. Nor could we be certain in the third place that any such organization, if it came into being, would be prepared to take over intact the Economic Section of the League. It is a matter of great satisfaction to record that all three of our hopes have been fulfilled and that our purpose in bringing the members of the League Economic Section to Princeton has now been accomplished. The result is that the technical economic work of

the United Nations can date its beginning not from 1946 but from 1920.

The members of the League group have been pleasant colleagues at the Institute. Thanks to the generosity of the Rockefeller Foundation, which has provided funds for research over and above the salaries paid by the League, the group has produced during the last six years the most creditable series of publications. Certain members of the group are resigning for other positions. Miroslav A. Kriz left the League service in June 1945 to take a position with the Federal Reserve Bank of New York. Alexander Loveday has been elected a Fellow of Nuffield College, Oxford, but is spending a term in research at the Institute before taking up his new duties. Ragnar Nurkse will make a study of inventories for the Committee on Economic Development, doing his work at the Institute, and John Lindberg will remain at the Institute for two years as a Fellow of the Rockefeller Foundation.

As a logical sequence to the theoretical work which he has been doing for some years on the mathematical and logical problems involved in very high-speed electronic computing, John von Neumann has begun this year the construction of an all-purpose computer. This project, which is supported partly by the Institute and partly by the Army Ordnance Department and which is conducted in cooperation with the Princeton Laboratories of the Radio Corporation of America and Princeton University, is described in the chapter on the School of Mathematics. A building to house the computer is now under construction. When finished

the computer will be devoted to theoretical work in mathematics such as the solution of non-linear differential equations and the theory of meteorology rather than to practical problems.

The housing shortage in Princeton is even more acute than in most university towns and has been for many years. It has been created partly by the recent advent of research groups connected with the Institute for Advanced Study and the laboratories of the Radio Corporation of America. The difficulty of housing our members has now become so great that the Trustees were faced this summer with the necessity of doing something to meet it or, as an alternative, curtailing the activities of the Institute. We have been so fortunate as to be able to purchase from the Federal Public Housing Authority eleven buildings containing roomy and comfortable apartments for thirty-eight families. During the summer these buildings are being transported from their present location at Mineville, New York, and are being erected in the square bounded by Cook and Goodman Roads between Springdale Avenue and Olden Lane. They will solve our housing problem until such time as it is possible to build more permanent structures.

One great advantage of the location of the Institute in Princeton is the Princeton University Library, the facilities of which have from the beginning been placed freely at the disposal of our Faculty and members. In return for this generosity the Trustees of the Institute voted last year to make a con-

tribution of $500,000 to the new Princeton University Library building in which quarters for Institute readers will be provided.

The Princeton Library does not relieve us from the necessity of maintaining a library of our own in Fuld Hall. With a special gift from Mr. Bamberger, the Institute began to build up that library in 1940. It consists of a general library and the libraries of the three different Schools, which are organized in a different way for each School. The total number of volumes at present amounts to about 27,000 to which a considerable number of unbound periodicals and pamphlets is to be added. Both the library of the School of Humanistic Studies and of the School of Economics and Politics are adapted to the special fields of research and special needs of the members of their present staffs. The Mathematical Library has a more universal character; its aim is a fair degree of completeness in the entire field of advanced mathematics, including theoretical physics, from about 1880 on. It is remarkable that in spite of the difficult times, which closed most of the European book market, something like 75% of the goal has been reached. Our effort is to keep our own library purchases down to the lowest possible level consistent with our needs, but it is already clear that we shall in a few years accumulate a fairly large collection for which more room will be needed than is now available in Fuld Hall.

In December 1945, Wolfgang Pauli was awarded the Nobel Prize in Physics for his discovery of the

so-called Pauli exclusion principle—an award which was celebrated by a dinner in honor of Professor Pauli given in Fuld Hall on December 10th, the day when the prizes were awarded in Stockholm.

The war service record of the members of the Institute faculty is an extremely interesting and creditable one. Fifteen members out of a staff then numbering eighteen gave part or all of their time to war work. The secrecy which still attaches to much of their research makes it impossible even now to give a full report on the war activities of the members of our staff. Three members of the faculty have been publicly recognized for their contributions to the war effort. Professor Morse has received a Citation for Meritorious Civilian Service from the War Department for work on the proximity fuse and other problems in ordnance; Professor Earle received the Medal for Merit for his work for the Army Air Forces and other phases of the war effort. Professor von Neumann has received the Distinguished Civilian Service Award from the Navy Department for his work on shock waves and detonation.

Details of the war activities of the members of the faculty insofar as they can be made public are as follows:

SCHOOL OF MATHEMATICS

James W. Alexander: Operational research; defense against enemy mining operations; spent some time in England in 1942 at Headquarters of Bomber Command of

Eighth Air Force working on the problem of improving the bombing accuracy of our planes over Germany. Published several confidential reports.

Albert Einstein: Consultant to Navy Bureau of Ordnance doing his work in Fuld Hall.

Marston Morse: Technical Expert, Office of Chief of Ordnance, U.S. Army. Member of Executive Committee of Applied Mathematics Panel. Consultant to NDRC on photogrammetry and proximity fuse. Wrote some eighty technical reports on bomb ricochet, the design and use of bombs, shells and rockets, fragmentation theory and tests. Made the preliminary mathematical analyses of the optimum heights and effects of the proximity fuse. Wrote the standard directions issued by the Ordnance Department to the using services on the use of shells and bombs for fragment damage.

John von Neumann: Consultant to Ballistic Research Laboratory of Army Ordnance Department at Aberdeen since 1937. Consultant to both Army and Navy on shock waves and theory of high explosives. Member of Division 8 and later of Division 2, NDRC. Directed project for the Applied Mathematics Panel. Studying computing methods suited to very high-speed computing devices which will become available in the near future. Since September 1943 consultant to the Manhattan District at the laboratory at Los Alamos.

Oswald Veblen: Consultant throughout the war to the Army Ordnance Department at Aberdeen Proving Ground; operational research for the Navy in connection with submarine mine warfare; member of Applied Mathematics Panel of NDRC; made one trip to England for the Army Air Forces.

Hermann Weyl: Special adviser to NDRC; consultant of Applied Mathematics Panel; did research on shock waves in Fuld Hall.

SCHOOL OF ECONOMICS AND POLITICS

Edward Mead Earle: In 1941 and 1942 assisted in the organization of the Division of Research and Analysis of the OSS. Since 1942 special consultant to the commanding general of the AAF for the purpose of organizing the advisory committee on bombardment, subsequently named Committee of Operations Analysts which made the plans for the bombardment of Germany and later of Japan. Made two trips to Europe as adviser to the Eighth and Ninth Air Forces and has now been commissioned to write a history of the heavy bombardment effort in the European theater of operations from 1942 to 1945. Served three months in 1944 on a special committee of the State, War, and Navy Departments in drafting documents for the German surrender and, also, the Dumbarton Oaks Conference. Published *Makers of Modern Strategy* which has been warmly received as the outstanding work dealing with that subject.

David Mitrany: Has been on leave since 1939, first as a member of the Chatham House group working for the English Foreign Office, later as adviser on international affairs to Lever Brothers.

Winfield W. Riefler: Assistant to the Secretary of the Treasury, September 1939 to January 1940. Drew up in July 1941 at the request of Vice-President Wallace, the first plan for the Board of Economic Warfare; Stationed in London, March 1942 to September 1944, first as Assistant to Ambassador Winant, then as head of the Economic Warfare Division in London with the rank of Minister, Professor Riefler built up an organization in which was concentrated all matters pertaining to the Anglo-American blockade of Germany, the management of the black list in the Eastern Hemisphere, economic and financial negotiations with European neutrals, the gathering and analyses of economic intelligence with respect to the enemy for the use of the armed forces and the civil government. Under this latter head, intimate and direct liaison was maintained with

the Air Forces, the European Theater Commander, the American Naval Commander in European Waters.

Walter W. Stewart: Full-time adviser to the Secretary of the Treasury, September 1939 to 1940, and part-time adviser 1940-1943.

Robert B. Warren: Consultant to the United States Treasury throughout the whole period of the war.

School of Humanistic Studies

E. A. Lowe: Member of General Arnold's Committee of Historians for studying the effect of the bombing of Germany. Assisted in the preparation of a handbook on archives and libraries of Italy for the use of our army of occupation.

Benjamin D. Meritt: Began in 1941 work for the Foreign Nationalities Branch of Colonel Donovan's organization which afterwards became the OSS. Supervised study of foreign language newspapers published by 36 foreign national groups within the United States. Spent a year in Washington in this work. Assisted in the preparation of a geographical handbook on Greece for the use of the Armed Forces.

Erwin Panofsky: Contributed to the preparation of maps and tables of information about the cultural monuments in Germany for the use of the American air force and artillery. Drs. Weitzmann and Frankl assisted in the same project. Dr. Lee edited a handbook of the art treasures in Italy, likewise intended for our armed forces, and Dr. de Tolnay assisted in the preparation of a similar book covering the city of Paris.

Frank Aydelotte: Chairman, New Jersey Enemy Alien Hearing Board, 1941-1942; Chairman, Committee on Scientific Personnel, OSRD, 1942.

During the past year the Institute has suffered a sad loss in the death of John R. Hardin, Chairman

of our Board of Trustees. Mr. Hardin was one of the most prominent citizens of Newark. He practiced law for many years and acted as Mr. Bamberger's legal advisor during the greater part of Mr. Bamberger's active life. Since 1924 Mr. Hardin has served as President of the Mutual Benefit Life Insurance Company of Newark. He was formerly a Trustee of Princeton University and has been a Trustee of the Institute for Advanced Study from the time of its foundation until his death. Since 1942 he has served as Chairman of the Board. He brought to the Institute a great store of practical wisdom and experience. He will be sadly missed from our deliberations.

II

SCHOOL OF MATHEMATICS

I n the School of Mathematics work is carried on by individual research, individual contact between permanent and temporary members, by seminars, by courses of lectures and by other means, as each member sees fit. In the past the work of the permanent staff has been greatly amplified by the activities of the temporary members, and it is expected that the same will be true in the future. The lectures and seminars, held either in our own building or in Fine Hall on the campus of Princeton University, are open to advanced students in the University, while, *vice versa*, University courses in mathematics are open to members of the Institute. There is the closest cooperation by both groups in seminars as well as in the Mathematics Club.

James W. Alexander is working to establish a closer connection between topology and differential geometry, mainly by generalizing the notion of a differential form so as to be applicable to an arbitrary topological space.

Richard F. Arens is working on the topology of spaces of continuous transformations, including linear spaces of continuous functionals, and groups of homeomorphisms.

Valentine Bargmann has been assisting Professor von Neumann and on his own account has been working on unitary representations of the Lorentz group.

Salomon Bochner has been working with Professor von Neumann on computational solutions of the wave equation.

Shiing-Shen Chern has during the last two years been occupied with the characteristic cohomology classes of Riemannian and Hermitian manifolds; generalizations of the theorem on the indeformability of the sphere; and Laplace transforms in differential geometry.

Edward M. Corson is investigating the theory of perturbation within the framework of Dirac's calculus of quantum mechanics.

Nelson Dunford pursued his researches in modern functional algebra.

Albert Einstein is continuing his research for the construction of a unified field theory of relativity generalizing Riemannian geometry by considering field equations for fields of a non-symmetric tensor.

Ky Fan is working on functional analysis and abstract spaces.

Kurt Gödel has been continuing his investigations about Leibniz, which will probably occupy him also during the next academic year.

Paul R. Halmos has been studying measure theory.

Maximilian J. Herzberger developed a direct method of a n-dimensional vector analysis which serves as a basis to coordinate different fields of mathematics and classical physics. At the moment the problem of geodetic manifolds of smaller dimension on surfaces of higher dimension is investigated.

Edwin Hewitt is studying the characterization of abstract spaces by means of their continuous images in simple spaces and by means of various families of such mappings.

Ning Hu has been working on a general theory of radiation damping.

John L. Kelley's principal work this year has been in topology with some applications to analysis.

George L. Kreezer has been working on the extension of the mathematical theory of feed-back mechanisms to physiological regulatory systems.

Alice Ambrose Lazerowitz is engaged in work in logic and philosophic foundations of mathematics.

Shih-Tsun Ma is investigating problems in field theories of elementary particles.

Pesi Masani during the first term helped Professor Morse with his biography of George D. Birkhoff, and during the second term has been working in noncommutative analysis and self-adjoint boundary value problems.

Walther Mayer has carried on research dealing with certain aspects of topology and variation calculus and intends to continue these studies next year.

Deane Montgomery, besides collaborating with Professor von Neumann on adapting mathematical problems to the use of high-speed computing machines, has investigated topological groups of transformations in the large and related questions of topology.

Marston Morse is continuing his work on methods in topological analysis and envisaging study of the topological causes of the planetary orbits, or of non-linear integral equation theory.

Francis J. Murray has been studying functional equations associated with cam mechanisms and the development of linear equation solvers. Next year he will investigate non-linear operators and general partial differential equation theory.

Otto E. Neugebauer, whose work would be equally relevant in the School of Mathematics or in the School of Humanistic Studies, has been mainly concerned with the preparation of a "corpus" of late Babylonian astronomical texts, containing the systematic computation of lunar and planetary phenomena. This edition is intended to form the documentary basis of a larger work on the history of ancient astronomy.

John von Neumann's work in 1945-1946 was in the following fields: theory of linear spaces, various parts of fluid dynamics, and various questions connected with the mathematical and logical principles and the actual development of very high speed automatic computing. He expects to continue to work in these subjects in 1946-1947.

Gordon N. Patterson has been making a review of modern fluid mechanics to be used as a basis for further research in this field.

Wolfgang Pauli continued his earlier work on the theory of the meson field. He lectured on this subject at Massachusetts Institute of Technology and at Columbia University.

A. Everett Pitcher is working on homology theory and some of its applications.

Abraham J. Sachs, in addition to collaborating with Otto E. Neugebauer in the publication noted above, has been making preparation for a study of ancient Mesopotamian metrology and has been engaged in a systematic search for unpublished Babylonian mathematical and astronomical texts among the 20,000 tablets at the University Museum in Philadelphia and the 3,000 tablets at the Princeton Theological Seminary.

Robert Schatten has been occupied with the study of linear transformations and cross-spaces.

Irving E. Segal is investigating the structure of algebras of functions on locally compact groups. He is also investigating methods of obtaining, by a process involving a finite number of arithmetical operations, arbitrarily close approximations to the solutions of the non-linear, partial differential equations of compressible supersonic flow.

Carl L. Siegel's research concerned algebraical, geometrical and analytical theory of numbers, differential equations, group theory. He gave a course on analytical number theory at New York University, and he delivered the Putnam Memorial Lectures at Harvard University.

Ernst G. Straus has been assisting Professor Einstein in his work on unified field theory.

Feodor Theilheimer has devoted his time to the study of topological groups, in particular Lie groups.

William R. Transue's research with Professor Morse is concerned with quadratic forms in relation to calculus of variation.

Hsio-Fu Tuan has continued to work on modular representations of finite groups and on Lie algebras.

Oswald Veblen continued his studies of the theory of spinors, with particular attention to the binary case.

Hermann Weyl has carried on studies on algebraic invariants and in philosophy of science. He plans to give a course on integral equations next year.

Leo Zippin engaged in research in topological transformation groups and related topics.

A quarterly journal called *Annals of Mathematics*, two collections of advanced mathematical texts known as the *Princeton Mathematical Series*, and the photoprinted *Annals of Mathematics Studies*, are published by the Princeton University Press under the joint sponsorship of the Department of Mathematics of Princeton University and the School of Mathematics of the Institute for Advanced Study. The editors of the *Princeton Mathematical Series* are Marston Morse, Howard P. Robertson, and Albert W. Tucker. The editorial board of the *Annals of Mathematics* consists of Solomon Lefschetz and John von Neumann, and associate editors from various institutions.

The following is a list of courses given by members during 1945-1946:

JAMES W. ALEXANDER: Applications of topology to differential geometry (discussion of manifolds, co-cycles, differential forms, and the problem of de Rham)

WALTHER MAYER: Selected topics in topology

MARSTON MORSE: New topological methods in the theory of meromorphic and interior transformations of a single complex variable

CARL L. SIEGEL: Transcendental numbers

HERMANN WEYL: Theory of groups

In seminars, members of Princeton University and the Institute often join hands. The following seminars were entirely or partly conducted by members of the Institute:

Fluid Dynamics Seminar, conducted by Walter Bleakney, Rudolf Ladenburg, John von Neumann and Abraham H. Taub

Theoretical Physics Seminar, conducted by Wolfgang Pauli, Josef Jauch, John A. Wheeler and Eugene P. Wigner

Topological Algebra Seminar, conducted by Richard F. Arens, Irving E. Segal and Hsio-Fu Tuan

The same cooperation prevails in the Mathematics Club and in sponsoring lectures by visitors from outside. Among the papers presented during the period from January 1945 to June 1946 the following may be noted as indicating the scope and variety of subjects:

JAMES W. ALEXANDER: A theorem of de Rham

T. W. ANDERSON, JR.: The problem of linear regression in econometrics

RICHARD F. ARENS: Topologies for spaces of transformations; Homeomorphisms of locally connected locally compact spaces; A characterization of the space of continuous functions over a compact Hausdorff space

EMIL ARTIN: Valuation theory; Product formula and ideal theory

VALENTINE BARGMANN: Masses of light nuclei; Unitary representations of the Lorentz group

A. L. BLAKERS: Determination of the homology sequence by the homomorphisms of the homotopy sequence

J. M. BLATT: Brownian motion

SALOMON BOCHNER: Group invariance of Cauchy's formula

RICHARD BRAUER: On the arithmetical properties of the representations of finite groups

G. W. BROWN and M. M. FLOOD: Glass container mortality

SHIING-SHEN CHERN: Homotopy groups

CLAUDE CHEVALLEY: The exceptional Lie groups and the principle of triality; Semi-simple rings; Some recent developments in the theory of Lie groups; Analytic manifolds and their triangulations; Differentials on algebraic varieties over fields of characteristic p

D. R. CROSBY: Unified theory of gravitation and electromagnetism in Finsler space

NELSON DUNFORD: Resolutions of the identity

SAMUEL EILENBERG: Equivariant homology theory; Antipodic theorems; Kakutani's fixed-point theorem

HERBERT FEDERER: Hausdorff measure and the Gauss-Green theorem

EUGENE FEENBERG: Velocity modulation

RALPH H. FOX: Knots in 3-dimensional manifolds; The word problem in partly Abelian groups

A. A. FRAENKEL: On the axiom of choice

CARLOS GRAEF-FERNANDEZ: A problem in differential equations in the large

N. T. HAMILTON: Theory of local rings

T. E. HARRIS: Distribution of the largest of a set of variance ratios

EDWIN HEWITT: Some curious topological spaces; Normed function rings

GERHARD P. HOCHSCHILD: Cohomology groups of algebras;

Extensions and representations of algebras; Tannaka's theorem

G. A. Hunt: Cumulative sums of random variables

Nathan Jacobson: On the theory of primitive rings

Samuel Karlin: Independent functions

John L. Kelley: Universal homology groups; A characterization of the space of continuous functions over a compact Hausdorff space

Rafael La Guardia: Topics related to the Laplace transformation

Howard Levi: Differential polynomials

Saunders MacLane: Group extensions and cohomology

Karl Menger: On hyperbolic geometry

Deane Montgomery: Groups of differentiable transformations

L. J. Mordell: The geometry of numbers

Francis J. Murray: Rings of operators

Luis Nanni: A two-sample test for a linear hypothesis whose power is independent of the variance

Otto E. Neugebauer: The Babylonian theory of the moon

John von Neumann: Logics of quantum mechanics; High speed computing and its applications; Shock reflection; Shock waves and their interaction

I. Opatowski: Markoff chains from an applied viewpoint

J. C. Oxtoby: Invariant measures in non-locally compact groups

A. Everett Pitcher: Exact sequences in homology theory

Harry Pollard: The problem of strong convergence

Tibor Rado: Frechet surfaces; The transformation of double integrals

Howard P. Robertson: Kinematical cosmology

Pierre Samuel: Totally ordered groups

Irving E. Segal: Group algebras of locally compact groups; Foundations of Lie group theory; Irreducible unitary representations of locally compact groups; The Gelfand-

Neumark representation theorem for commutative algebras on which an adjoint operation is defined; Positive definite functions on a locally compact group

Max Shiffman: Differentiability of solutions of variational problems in multiple integrals

Lincoln G. Smith: Comparison of theory and some experiments on shock reflection

Ernst Snapper: Polynomial matrices in several variables

D. C. Spencer: A variational method in conformal mapping

Norman E. Steenrod: Products of cohomologies

Abraham H. Taub: The fundamental equations of fluid dynamics

Hsio-Fu Tuan: On replicas of matrices and algebraic Lie algebras

Albert W. Tucker: Real quadrics as sphere bundles; Harmonic problems in networks, complexes and manifolds; Abstract harmonic structure

Bryant Tuckerman: On a certain three-dimensional manifold

John W. Tukey: Median and moral estimates of parameters; General tolerance regions

D. F. Votaw: The probability distribution of a random linear set

J. E. Walsh: Concerning the effect of intra-class correlation on certain significance tests for samples of size 2^n

Bruce Weber: Some improvements in weighing and other experimental techniques

Gregor Wentzel: Some aspects of meson theory

John A. Wheeler: Some mathematical aspects of action at a distance

George W. Whitehead: Families of continuous vector fields on the sphere; On homotopy groups of spheres; Obstructions and extensions

S. S. Wilks: A statistical test for equality of variance and equality of co-variance in a normal multivariate population

OSCAR ZARISKI: The concept of a simple point of an abstract algebraic variety; Holomorphic functions on abstract varieties and the principle of degeneration

A. ZYGMUND: Smooth functions

HIGH SPEED COMPUTING

John von Neumann has for some time past been studying the approximation methods which are likely to be important in high speed computing. This work was supported by the United States Navy Bureau of Ordnance, and was carried on with the collaboration of Valentine Bargmann, Deane Montgomery and Salomon Bochner.

A project aimed at developing a fully automatic high-speed electronic computing machine is in progress. The Institute is now building up certain necessary laboratory facilities, and employing an engineering staff. The project is supervised by Professor von Neumann, with the help of Julian H. Bigelow and Herman H. Goldstine. It is supported by the United States Army Ordnance Department and carried out in cooperation with the Princeton laboratories of the Radio Corporation of America under the general direction of V. K. Zworykin who is assisted by J. Rajchman and G. W. Brown. Further help is being obtained from Princeton University, which has, in particular, made available the consulting services of John W. Tukey.

It is intended to carry out in 1946-1947 work in theoretical meteorology, especially because the

planned computer will make possible calculations that are likely to permit the utilization of meteorological theory to an extent beyond what is so far feasible. A project with such an objective will be sponsored at the Institute by the United States Navy, Office of Research and Inventions. It is likely to be of a duration similar to that of the computer project and will be supervised by Professor von Neumann with the help of H. Wexler from the United States Weather Bureau.

Further details will be given as work in these fields progresses.

III

SCHOOL OF ECONOMICS AND POLITICS

THE School of Economics and Politics undertakes to provide a setting suitable for the pursuit of the individual studies of its members. On the basis of their background and experience, selected scholars are invited to become members for a limited period, if the Institute seems the most appropriate place for them to pursue their studies and provided such studies are related to the work currently in progress. Ample opportunity exists for informal conferences with members of the permanent staff and with other members; special seminars are arranged on occasion and contact is maintained with individuals and institutions outside of Princeton.

In addition to their work within the School, the individual members of the permanent staff maintained or renewed various specialized activities.

In the autumn of 1946 Edward Mead Earle will resume his seminar on international politics, with special reference to problems of British and American security. During the first term he will have associated with him E. L. Woodward, Montague Burton Professor of International Relations at Oxford University, Denna Fleming, Professor of Political Science at Vanderbilt University and William B. Willcox, Associate Professor of History at The University of Michigan. As in the past, members of the Princeton University faculty will participate in the work of the seminar. Professor Earle will also continue his own studies of American foreign relations and of the impact of air power on international affairs.

Winfield W. Riefler completed his work as Chairman of the Delegation on Economic Depressions. Part II of the Report of the Delegation, *Economic Stability in the Post-War World*, was published in April, 1945. During the autumn Professor Riefler concentrated on problems raised by the advent of atomic energy and was appointed Chairman of the Social Science Research Council Committee on Social Aspects of Atomic Energy.

Walter W. Stewart and Robert B. Warren have continued their study of the financial aspects of contemporary economic developments with particular reference to post-war financial adjustments.

David Mitrany who has continued on leave of absence acting as political advisor to Lever Brothers in London has published during the past year *Economic Development in S. E. Europe* and *American Interpretations*. It has already been noted that Professor Mitrany has resigned his professorship in the Institute and has been elected to permanent membership. An arrangement has been made by which he will spend a few weeks at Princeton each year and it is hoped that he will be able later to return to Princeton for an extended period of research.

Several members of the School have continued the work upon which they were engaged during the preceding year. Richard P. Blackmur, on leave from

Princeton University, has completed his study of Henry Adams; Lucius Wilmerding, Jr. continued his writing of the history of the government accounting offices; Walter Schiffer, whose appointment as a Guggenheim Fellow was renewed, is preparing a study on the conflicting theoretical ideas underlying the origin and activities of the League of Nations and Clarence D. Long Jr., after his release from the Navy, resumed his study of the magnitude and changes in the labor force in this country over the past three decades.

Norman S. Buchanan, on leave from the University of California and Friedrich A. Lutz, on leave from Princeton University, with the support of the Twentieth Century Fund, have been studying problems connected with international exchange, commercial policy, international investment and international monetary arrangements. John C. Cooper is engaged in a study of the legal and political problems of international civil aviation and related phases of air power. Alexander Loveday, who became a member upon his resignation as Director of the Economic, Financial and Transit Department of the League of Nations and who has been appointed a Fellow at Nuffield College, is engaged in a study on democratic philosophy and economic doctrine. William O. Aydelotte, at present the holder of the Hodder Fellowship at Princeton University, is making a study of Charles Dickens and his relation to the history of his times.

E. A. Goldenweiser, who recently retired as Economic Adviser to the Board of Governors of the Federal Reserve System and who is President of the American Economic Association for the year 1946, became a member of the Institute during the current year. Alexander Baykov, a Rockefeller Fellow on leave from the University of Birmingham, England, during his membership completed his manuscript on Soviet Foreign Trade which will be published by the Princeton University Press. Noel Hall, during the war British Minister to the United States in charge of Economic Warfare, has been engaged in a study of the theory of interest rates. Richard Stone, Director of the Department of Applied Economics, Cambridge University, completed a study of the Definition and Measurement of the National Income and Related Totals which will be published by the League of Nations. Mrs. Feodora Stone, Secretary of the National Institute of Economic and Social Research, London, England, during the period of her membership visited various economic research institutes in the United States and studied their organization and techniques of investigation.

IV

LEAGUE OF NATIONS

DURING 1945 the members of the Economic, Financial and Transit Department of the League of Nations* who came on mission from Geneva in 1940 have, together with their locally engaged collaborators and assistants, continued to work at Fuld Hall under the direction of Alexander Loveday, and a number of League Committees have met in Princeton.

The League's Delegation on Economic Depressions, which published the first part of its report in 1943 under the title *The Transition from War to Peace Economy*, held five sessions in Princeton during the winter of 1944-1945 under the chairmanship of Winfield W. Riefler and the second part of its report entitled *Economic Stability in the Post-War World* was published in April of this year. This volume deals with the long term problem of cyclical fluctuations in economic activity and with the means by which a high and stable level of employment may be maintained.

The Economic and Financial Committees of the League met in joint session in Princeton in April 1945 to consider a draft report prepared by the Department on the Committees' experience of intergovernmental efforts to reduce obstacles to international trade and to secure equitable treatment for the com-

* List of officials given on page xiii.

merce of all nations. This report, which is a substantial volume of 124 pages, was published in July 1945 under the title *Commercial Policy in the Post-War World*.

During their session the Committees also arranged for a special enquiry to be made into problems of post-war private foreign investment, and a number of meetings of a special committee appointed to deal with this question were held in November and December.

Two Sub-Committees of the League's Committee of Statistical Experts met in June 1945, the one dealing with banking statistics and the other with statistics of international balances of payments and reports were approved for circulation to governments for comments. In addition a draft report was prepared by Richard Stone, Director of the Department of Applied Economics of Cambridge University, on statistics of national income. This report was submitted to another sub-committee in December 1945.

A volume was published early in the year entitled *Model Bilateral Conventions for the Prevention of International Double Taxation and Fiscal Evasion* which contained the text of three model conventions adopted by the Second Regional Tax Conference of the League of Nations Fiscal Committee, together with a Commentary.

New editions of two of the Department's regular pre-war publications—*The World Economic Survey 1942-1944* and *Money and Banking 1942-1944*

have been prepared and issued in Princeton. A large part of the material contained in *The Statistical Year-Book of the League of Nations 1942-1944* was collated in Princeton and sent to the League headquarters in Geneva where the Year-Book was published. Since the beginning of 1943 the Princeton group has been publishing an edition of the *Monthly Bulletin of Statistics* parallel with that issued in Geneva. But as a result of the improvement in postal communications, the Princeton edition was discontinued after the September issue; since then the Princeton group has confined itself to helping in the preparation of the Geneva edition.

Amongst other studies in course of preparation or in the press are:

Industrialization and Foreign Trade.
A Study on the Control of Inflation.
A Study on International Raw Materials Problems 1919-1939, on which Klaus E. Knorr is collaborating.
A Study on Rationing and Relief.
A volume on National Balances of Payments.
A collection of memoranda on Customs Unions.
Economic Demography of Eastern and Southern Europe by Wilbert E. Moore.
The Population of the Soviet Union by F. Lorimer.
Europe's Population in the Inter-War Period by Dudley Kirk

The last three volumes, all of which are in the press, have been prepared for the Department by the Office of Population Research of Princeton University.

The Department has remained in regular correspondence with numerous national reconstruction committees and government departments concerned with post-war economic and financial problems and has taken an active interest in the discussions of the future organization of international economic and financial work. The Director, Alexander Loveday, was a member of the League of Nations delegation of "unofficial representatives" at the San Francisco Conference (April-June 1945) while Martin Hill, a member of the Department, was seconded to the Conference Secretariat and has been assisting the United Nations Preparatory Commission in London since July 1945. Dr. Loveday and Shan K. Fong attended the Conference of the Institute of Pacific Relations at Hot Springs in January 1945 and another member of the Department, Paul Deperon, attended the Inter-American Conference on Problems of War and Peace in Mexico City (February-March 1945) as an observer. Dr. Loveday went to London on mission in September and returned at the end of November. On this occasion he spent a few days at the headquarters of the League in Geneva, Switzerland.

V

SCHOOL OF HUMANISTIC STUDIES

BENJAMIN D. MERITT, before leaving to assume his duties as Eastman Professor at the University of Oxford, completed several studies of Greek inscriptions, some of which have already appeared in the *American Journal of Philology* and *Hesperia*; others are scheduled for forthcoming numbers. Professor Meritt continues to direct the epigraphical work of the Agora excavations of the American School of Classical Studies at Athens and to serve on the School's Publications Committee, of which he is chairman.

W. Kendrick Pritchett, of the staff of the American School, recently discharged from the Army Air Corps in which he held a captaincy and served both in the Pacific and in Europe, has returned to the Institute and is engaged in study and publication of inscriptions discovered in the School's excavations in the Athenian Agora. Mr. Pritchett has also resumed his duties as editor of *Athenian Citizens*, *Prosopographia Attica*, the compilation of which had come to a stop during the war. Together with O. Neugebauer, he will have ready for publication next fall the manuscript of their monograph on the calendars in use at Athens from the fifth to the first century B.C. In this work they survey the historical and epigraphical evidence for the Athenian calendars and present an interpretation of the material in the light of the known calendar systems of Antiquity. They expect to propose hypotheses which change the relationship between the conciliar and civil calendars within individual years.

A. E. Raubitschek and Father Creaghan, S.J., who were members last year, completed a study of early Christian inscriptions from Athens and with Father Loughran, S.J., Mr. Raubitschek prepared a short study of three Attic proxeny decrees. He also collaborated with Professor C. M. Dawson of Yale University in publishing "A Greek Folksong Copied for Lord Byron." In addition, Mr. Raubitschek, during his year's residence in Princeton, completed the epigraphical indexes of the general index to *Hesperia*, Vols. I-X, and *Hesperia* Supplements, Vols. I-VII; Mr. Raubitschek left Princeton in the fall of 1945 to accept an assistant professorship at Yale.

Paul A. Clement continues his duties as managing editor of publications for the American School. Elected to the Managing Committee from the Institute, he has been appointed to the Publications Committee of the School and is serving as acting chairman of that committee in the absence of Professor Meritt. In addition to his editorial work for the School Mr. Clement is preparing an edition of Plutarch's *Quaestiones Convivales* for the Loeb Classical Library. During the year he has printed a short note "*Moralia* 614 E" (*American Journal of Philology*, LXVI, 1945, pp. 192-196).

William W. Wallace of the University of Toronto, during a period of residence at the Institute in

the spring of 1946, completed an historical and topological study on the demes of the ancient Greek state of Eretria.

John H. Kent on appointment from the American School of Classical Studies at Athens is preparing a publication of Greek and Latin inscriptions found in the School's excavations at Corinth.

John V. A. Fine, Associate Professor of Princeton University, is engaged in a study of ancient Greek mortgage records.

Miss Hetty Goldman has put the completed manuscript of the first volume on *Excavations at Tarsus* in the hands of the Princeton Press and is now at work on the second volume. She has received leave of absence from the Institute for the academic year 1946-1947 and hopes, if conditions in the eastern Mediterranean are favorable, to return to Tarsus for purposes of study and limited excavation, together with a number of her former assistants.

Miss Virginia Grace, sometime Fellow of the American School, has come to the Institute from the State Department where she has spent the war years working in several Middle Eastern countries. She is now occupied with a *corpus* of Greek stamped amphoras, containers in the international commerce of the Hellenic world. Collected and systematized this material will constitute a valuable body of evidence on a phase of Graeco-Roman economics. Current articles completed are "Early Thasian Stamped Amphoras," and "Persons Named on Thasian Amphora Stamps."

Miss Berta Segall has completed four chapters of her projected book on the lost arts of Alexandria. In addition she has prepared an article entitled, "Thessaly and Alexandria" based upon two golden medallions in the Museum of Historic Art at Princeton which will appear in the Museum's publication *The Record*. A second article to appear in *Hesperia* will deal with "An Alexandrian Bozzetto" which Miss Segall recognized in a private collection in Princeton as belonging to a find of goldsmith's models from Galjûb, north of Cairo.

Miss Frances Follin Jones has again divided her time between the Museum of Historic Art of Princeton University and her work with Miss Goldman. She has undertaken to see through the press the Tarsus volume, in the preparation of which she has collaborated.

In 1945 Erwin Panofsky completed and saw through the press his edition of and commentary upon the writings of Suger, Abbot of St.-Denis, which has appeared in 1946. He has published, apart from minor contributions to periodicals, the second edition of his book on Dürer. Professor Panofsky is now engaged in preparing a third edition of this book and in continuing his research in the field of Gothic art. Both in these studies and in the preparation of his Suger edition, he was effectively assisted by George H. Forsyth, Jr. When this is finished he hopes that political conditions will permit him to resume his work on early Flemish miniatures which was interrupted by the war. In the first term

of the academic year 1945-1946 he conducted a seminar on "Renaissance problems" for the graduate students in the Department of Art and Archaeology of Princeton University.

Kurt Weitzmann has continued his studies on manuscript illumination and the illustration of early books. His volume *Picture-cycles in Roll and Codex. A Study of the Origin and Method of Text-Illustration*," has been published by the Department of Art and Archaeology of Princeton University as Volume II of the *Studies in Manuscript-Illumination*. A second monograph, "The Joshua Robulus as a Work of the Macedonian Renaissance," and an article entitled "Book Illustration of the Macedonian Renaissance," are now in preparation.

Hanns Swarzenski, who has been working at the National Gallery of Art in Washington since 1943, has now returned to the Institute and will resume work at the beginning of the academic year 1946-1947.

Charles de Tolnay published, apart from several articles, the second volume of his work on Michelangelo (*Michelangelo, Vol. II: The Sistine Ceiling*, Princeton, 1945) and prepared the second edition of *Volume I: The Youth of Michelangelo*. He delivered a lecture on Architecture of Medieval Churches in Princeton and a lecture on the Medici Chapel in New York. The third volume of his work on *Michelangelo, The Medici Chapel* is now in preparation.

Otto Benesch has just published a book entitled: *The Art of the Renaissance in Northern Europe,*

Its Relation to the Contemporary Spiritual and Intellectual Trends. Harvard University Press, Cambridge, Mass., 1945.

The following books are in press and will appear in the spring of 1946: *Rembrandt's Drawings* (Selective edition), Oxford University Press, New York. *Venetian Drawings of the 18th Century in American Collections*. H. Bittner, New York. He is also contributing articles to the Henri Focillon Memorial Volume and the Encyclopedia of the Arts.

In the spring semester of 1946, Dr. Benesch will give a course on "French Painting of the 19th and 20th Centuries" at the Institute of Fine Arts, New York University.

George H. Forsyth, Jr. spent the last year in the preparation of the text volume of his monograph on the Church of Saint Martin at Angers in France. The folio volume of plates for this work has already been printed by the Department of Art and Archaeology of Princeton University and as soon as the text volume is ready, the two will be issued together. They will provide a record of our excavations under the church, an architectural survey of the building as it now stands, and an historical analysis of the various phases of development which are evident in these excavated remains and in the superstructure above them. Since the site has been occupied, with only a few interruptions, from the first century B.C. to the present, it offers information on a considerable number of periods in the history of French architecture. In particular, it adds appreciably to present

knowledge of the links which unite Roman architecture to Romanesque during the intervening Merovingian and Carolingian periods.

Paul Frankl is preparing a monograph on *Stained Glass of the Middle Ages*, which will be ready for publication in 1946.

E. A. Lowe has now completed four volumes of the *Codices Latini Antiquiores* and three more are in the advanced stage requiring only revision before going to press. It so happens that the next two volumes deal with manuscripts in France and their completion must wait until conditions in France and especially living costs have become such as to make scholarly work possible in that country.

During the past academic year Professor Leslie W. Jones of the College of the City of New York has been carrying on investigations of the School of Corbie and problems connected with the production of books in ancient times.

Hans Baron devoted the year to the beginning of certain portions of the manuscript of his comprehensive work on *Renaissance Liberty: Politics, Economics, Citizenship, and the Growth of Political Thought in the Florentine Commonwealth 1250-1550*. He has also completed a number of subsidiary investigations into the original sources for the major work, in the fields of the history of Florentine Humanism and the history of the Florentine Constitution. The first of these source-investigations to be published will be a study in book-form on *The Dates*

and Phases of Leonardo Bruni Aretino's Literary Production and Humanistic Development.

Ernst Herzfeld has taken advantage of the end of the war to make another trip to the Near East. Meanwhile his *Monuments et Inscriptions d'Aleppo* and his book on Zoroaster are in preparation at the Princeton University Press.

Before his return to Italy in September 1945, Doro Levi completed a two-volume work on the *Mosaics of Antioch* and the *History of Roman Art* which will be published by the Princeton University Press. During his stay at the Institute he wrote many articles, for example, "Vases of Cretan Pottery," which appeared in *Hesperia* and elsewhere. He lectured at Harvard University and at Princeton University on Greek archaeology, pre-Hellenic archaeology and Etruscan art. He also directed the completion of the list of Italian monuments and compiled maps for Italy for the Army authorities.

VI

GEST ORIENTAL LIBRARY

D u r i n g the nine and a half years while the Gest Oriental Library has been on deposit in temporary quarters at 20 Nassau Street, the books on the shelves have been accessible for use largely through the bibliographical work done upon them by I. V. Gillis, Commander U.S.N.R., of Peking (Peiping), China. Mr. Gillis, as a personal friend of and collaborator with Mr. Guion M. Gest, founder and former owner of the Library, prepared scholarly Bibliographical Notes on over half of the more than four thousand titles covering the collection of more than 100,000 Chinese stitched volumes (*ts'ê*). ·

From the establishment of the Library on Chinese New Year O.S., February 13, 1926, at McGill University, Montreal, Canada, until its present Curator, Dr. Nancy Lee Swann, joined the staff of the Library, June 1st, 1928, the Library was dependent upon Chinese student assistants for bibliographical notes on the first eight hundred accessions. While making attempts to check and to correct errors in earlier notes, as well as to cooperate with Commander Gillis in his volunteer service of preparation of scholarly Notes on later accessions, Dr. Swann wrote notes for accessions numbered 818 through 944, and supervised those from 945 through 1029, in order to have records up to 4050 generally accurate. At the time of the transfer of the Library to Princeton, New Jersey, in July, 1936, about two hundred and fifty acquisitions, numbered 3708 through 4050, had not yet been written up. Because the Library upon acquisition by The Institute for Advanced Study was placed temporarily in the status of storage, work on these and later acquisitions had to cease.

Meanwhile, in Peking, Commander Gillis, on his own initiative, prepared and had privately printed in a very limited edition a *Title Index to the Catalogue of The Gest Oriental Library*, in four Chinese stitched volumes bound in a blue cloth wrap-around-cover (*han*). In the late autumn of 1941, he managed to get out of Peking to America, four copies of the Index in addition to booklets containing its material which from time to time he had sent throughout the previous summer to the Library of Congress and to Dr. Swann. Now it is expected that when transportation is resumed, the publication will be distributed through a gift from the General Educational Board of the Rockefeller Foundation. With war in the Pacific on the horizon haste in getting his material into print prevented the compilation of an authors' index. So here at Princeton, for use in the Library, a card catalog of authors has been prepared from the Title Index. Labels are yet to be prepared for some five thousand *han*. Nevertheless, through a system of numbers for the more than fourteen thousand *han* containing the more than 100,000 stitched volumes (*ts'ê*), any title

held by the Library is accessible to a reader whose knowledge of Chinese makes possible its use.

In addition to the oriental bound volumes in the Gest Collection, there are also some four or five thousand volumes mostly on deposit by the Princeton University Library in the Gest Library. The greater part of these latter volumes are single western-style bound, although there are not a few Chinese standard works in the group purchased out of the gift to the University by the General Educational Board for promotion of Far Eastern Studies in the University. Catalog cards for these volumes, without respect to source of acquisitions, have been prepared in Chinese, Korean, and/or Japanese, as well as Manchu and Mongolian, and in the case of the Japanese in English transliteration, looking to the day when the Gest Library may possess a card catalog for all Far Eastern titles in Princeton, irrespective of location or ownership.

Through a more thorough examination of Gillis's Notes on Gest accessions, as well as personal examination of works for which no notes were made, the Curator of the Library, Dr. Nancy Lee Swann, has sought to establish how many of the more than four thousand main titles covering the contents of the collection are rare books within the definition of that term by modern Chinese bibliographers (that is, pre-1644, mainly Ming, A.D. 1368-1643 editions). Upon occasions of visits in the Library most valuable help has been offered by Wang Chung-min of the staff of the National Library of Peiping, who is now associated with the work on Chinese rare books in the Library of Congress. He has examined perhaps one-third of the total collection, the entire A section (Classics, including dictionaries) and probably two-thirds of the D section (literary writings, prose and poetry, of individual authors). He considers that among all the collections of Chinese books which he has examined, the Gest Collection holds a very important place. He found that of Gest's A section (Classics) rare works, seventy per cent are not duplicated either in the Library of Congress Orientalia Chinese section, or in the National Library of Peiping's rare book section. Of the D section (literary writings of individuals) rare books, he estimates that fifty per cent are not duplicated. These facts alone suffice to prove the value of the Gest Collection in Chinese scholarship and Chinese studies.

During the spring and summer of 1946, Dr. J. J. L. Duyvendak of the University of Leyden has been making a study of the resources of the Gest Library in preparation of a report for the Trustees on the way in which the Library can best be used to further Chinese studies in the United States.