



Establishing the Institute for Advanced Study

Princeton, New Jersey

*Establishing the Institute for Advanced Study*

The Institute for Advanced Study was founded in 1930 by Louis Bamberger and Caroline Bamberger Fuld, brother-and-sister philanthropists who sought to provide the world's leading scholars with the support and facilities to pursue curiosity-driven research that would enlarge our understanding of the world, leading to both cultural and practical benefits for humankind. When the Institute's main building, Fuld Hall, opened in 1939, it was named in honor of the late Felix Fuld, business partner of Louis and husband of Caroline.

This booklet contains a selection of founding documents that describe the purpose and ideals of the Institute for Advanced Study as articulated by the Bambergers and by Abraham Flexner, the founding Director.

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*Louis Bamberger*



*Felix Fuld*



*Caroline Bamberger Fuld*

## The Founders

*Letter of Invitation*

from

Louis Bamberger and Caroline Bamberger Fuld

June 4, 1930



The Institute's first Board of Trustees. Front row from left: Alanson Houghton, Caroline Bamberger Fuld, Louis Bamberger, Florence Sabin, Abraham Flexner. Back row from left: Edgar Bamberger, Herbert Maass, Samuel Leidesdorf, Lewis Weed, John Hardin, Percy Straus, Julius Friedenwald, Frank Aydelotte, Alexis Carrel.

*Louis Bamberger*

*Newark, N. J.* , June 4, 1930.

Dr. Abraham Flexner,  
c/o Rockefeller Institute,  
York Avenue and 66th Street,  
New York City.

Dear Sir:-

We are asking you to serve with us as trustees of an institution of higher learning which we propose to endow with a substantial initial sum, to which we expect from time to time hereafter to add amounts which in our belief will provide adequately for the establishment of the proposed enterprise.

There is at present little or no lack of schools and colleges for the training of young men and women for the ordinary baccalaureate degrees. This need will in the future be apparently even more fully supplied than at present. There are also attached to many of our colleges post-graduate schools doing effective work in guiding students in qualifying themselves for post-graduate degrees.

There is never likely to be an over-abundance of opportunities for men and women engaged in the pursuit of advanced learning in the various fields of human knowledge. Particularly, so far as we are aware, there is no institution in the United States where scientists and scholars devote themselves at the same time to serious research and to the training of competent post-graduate students entirely independently of and separated from both the charms and the diversions inseparable from an Institution the major interest of which is the teaching of undergraduates.

It is our desire, therefore, that the proposed institution shall contain no undergraduate department and that it shall bestow only the Ph. D. degree, or professional degrees of equal value, and that its standards of admission and methods of work shall be upon such a basis and upon that alone.

In so far as students are concerned, it is our hope that the trustees of the institution will advance the ideals upon which it is founded in such manner that quality of work rather than number of students shall be the distinguishing characteristic of the enrollment.

It is our hope that the staff of the Institution will consist exclusively of men and women of the highest standing in their respective fields of learning, attracted to this institution through its appeal as an opportunity for the serious pursuit of advanced study and because of the detachment it is hoped to secure from outside distractions.

*Louis Bamberger*

*Newark, N. J.*

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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.

In endowing this Institution we recognize that many worthy and capable persons are unable for financial reasons to pursue study or research to the extent justified by their capacities. It is expected, therefore, that the Institute will supply means whereby, through scholarships or fellowships, such workers may be supported during the course of their work or research, to the end that the facilities of the Institution may be available to any man or woman otherwise acceptable possessing the necessary mental and moral equipment.

While the Institution will devote itself to the teaching of qualified advanced students, it is our desire that those who are assembled in the faculty or staff of the Institution may enjoy the most favorable opportunities for continuing research or investigations in their particular field or specialty, and that the utmost liberty of action shall be afforded the said faculty or staff to that end.

It is not part of our immediate plan to create a professional school, and we do not contemplate that the trustees will sanction the development of the Institution in that or any other direction unless separate funds are assured which permit the undertaking of additional responsibilities upon the high level at which the enterprise is started and consistently with the whole spirit of the undertaking.

It will doubtless develop that most of the students admitted to this Institution for the purpose of obtaining a doctor's degree will before entering have received a baccalaureate degree or the equivalent thereof. The facilities of the Institution should, however, in the discretion of the trustees and the staff, be open to any acceptable student who may demonstrate his or her qualifications and fitness.

Many of those who enter the Institution will probably qualify themselves for professorships in other institutions of learning, but the Institution itself is established not merely to train teachers or to produce holders of advanced degrees. The

*Louis Bamberger*

*Newark, N.J.*

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primary purpose is the pursuit of advanced learning and exploration in fields of pure science and high scholarship to the utmost degree that the facilities of the Institution and the ability of the faculty and students will permit.

It is intended that the proposed institution be known as the "INSTITUTE FOR ADVANCED STUDY", and, in grateful recognition of the opportunities which we personally have enjoyed in this community, that it be located in the State of New Jersey.

It is our hope that the site, buildings, and equipment can be provided without impairment of the capital sum with which the INSTITUTE FOR ADVANCED STUDY will be endowed.

It is our express wish that gifts from outside sources shall never be accepted conditioned upon any modification of the fundamental aim for which this institution is created.

To the end that the most cordial and co-operative relations may at all times exist between the trustees and the faculty of the Institute, it is our further desire that certain members of the faculty shall be chosen to become members of the board of trustees.

This letter is written in order to convey to the trustees the conception which we hope the Institute may realize, but we do not wish it or any part of it to hamper or restrict our trustees in their complete freedom of action in years to come, if their experience with changing social needs and conditions shall appear to require a departure from the details to which we have herein drawn attention.

Faithfully yours,

*Louis Bamberger*  
*Cassius P. Gold*





*Remarks of the Director*  
*at the*  
*Organization Meeting*

October 10, 1930



THE INSTITUTE FOR ADVANCED STUDY  
*(FOUNDED BY LOUIS BAMBERGER AND MRS. FELIX FULD)*

ORGANIZATION

AND

PURPOSE

BULLETIN NO. 1

THE INSTITUTE FOR ADVANCED STUDY  
100 East 42nd St., New York  
December, 1930

## II

### REMARKS OF THE DIRECTOR AT THE ORGANIZATION MEETING

LADIES AND GENTLEMEN :

I welcome the opportunity afforded by the meeting called for the purpose of effecting the initial organization of the Institute for Advanced Study to state as clearly as I can what at present lies in my mind on the subject. With rare beneficence and far-sightedness, Mr. Bamberger and Mrs. Fuld have made us responsible for the creation of an institution devoted to advanced study. Now, new foundations, starting as does this with a clean sheet, without commitments and without traditions, are not likely even in America to be frequent occurrences. Their possibilities in the way of their own actual achievements and in respect to the influence which they may exercise upon other institutions are very great, and it is therefore with a very grave sense of responsibility that I have undertaken to devote myself to the inauguration of this Institute.

The general lines to be followed are made sufficiently clear in the letter which Mr. Bamberger

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and Mrs. Fuld addressed to those whom they invited to be its trustees. The Institute is pledged to assemble a group of scientists and scholars who with their pupils and assistants may devote themselves to the task of pushing beyond the present limits of human knowledge and to training those who may "carry on" in this sense. The urgent importance of creating such an institution has long been felt. In 1874, a committee of the Trustees of the Johns Hopkins University, searching for a president and a policy, visited Ann Arbor in order to confer with President Angell of the University of Michigan. Twenty-five years later, recounting the story, President Angell said: "The only idea that Dr. Frieze and I labored to impress upon them was that, in our judgment, the thing to do was not to erect another college, but to strike out boldly at once and make a graduate university." Since President Angell's memorable interview almost sixty years ago, the need has become much more acute, partly because of developments within the fields of science and scholarship, partly because of the increasingly chaotic conditions that prevail within existing American universities. In an institution of this kind, only one thing matters initially: the faculty. "It is," said President Gilman in one of the many addresses in which he emphasized this point, so often overlooked since his day, "it is on the faculty more than on any other body

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that the building of a university depends. They give their lives to the work. It is not the site, nor the apparatus, nor the halls, nor the library, nor the board of regents which draws the scholars; it is a body of living teachers, skilled in their specialties, eminent in their calling, loving to teach."

The Institute for Advanced Study is to be a graduate university in the highest possible sense of the term. Its faculty will, as I have said, be composed of distinguished scholars; its students will have already left far behind all the ordinary steps in education and discipline. Some may already have achieved independence; some may still require a limited amount of guidance. But they will not, in so far as we can judge and select, be immature or uncertain; nor will they in any department of intellectual activity be so numerous as to distract the members of the faculty from their own creative tasks. The choice of teachers and the choice of students will be no easy task; but we are under no necessity to proceed rapidly; and we shall make every possible effort to profit by the wisdom and experience of scholars, scientists, and administrators in this country and abroad before committing ourselves.

There are obviously several ways in which this Institute may begin its work. It might begin, for example, in the field of the physical and biological sciences, or it might begin in the humanistic field, in which I should include all those

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activities that deal with the doings and achievements of men viewed as human beings. It might conceivably begin in both. Where and how it begins must depend, in the first instance, on the men and women of genius, of unusual talent, and of high devotion, who may be found willing to be associated with us. Our first task is therefore to explore the field in this country and in the cultural countries of Western Europe in order to discover the talent likely to carry the Institute to success. My own mind is open. It is not, as I have already insisted, important that we act with dispatch. It is of extraordinary and fundamental importance that we make no initial mistakes. If I may again quote President Gilman — this time from the address made on the opening of the Johns Hopkins University in 1876: “It behooves us to observe and ponder, and, above all, to be modest in the announcement of our plans.”

I beg you therefore to be tolerant and patient, to the end that I may be under no constraint to ask for action on your part until I am fully persuaded that the action which I suggest is sound. I am fortunate in having myself witnessed the development of two institutions which have proved important factors in the intellectual life of this country: the Johns Hopkins Medical School and the Rockefeller Institute for Medical Research. Dr. Welch, who organized the Johns



Hopkins Medical School, went to Baltimore in 1885 when I was myself a student in the university there. He spent five years in assembling the faculty, which from that day to this has been the most distinguished school of medicine in the United States. He possessed judgment and wisdom, but he was also favored by circumstances, for, though his financial resources were limited, he was allowed to enjoy leisurely opportunity to acquaint himself with the entire field before he made a move. One of his own pupils had a similar opportunity some years later in establishing the Rockefeller Institute for Medical Research. He borrowed the technique which his own teacher, Dr. Welch, had so successfully employed with results that are for us and the rest of the world to judge. We shall, I hope, waste no time; on the other hand, we shall, I hope, feel under absolutely no pressure to act. In general, our steps should be tentative, provisional, experimental. We must avoid, as far as possible, errors which may bind and embarrass our successors.

I have one or two convictions based upon a long and varied experience, which I should like to submit to your consideration. I need not say that the opportunity to take the initial steps in founding this institution is little less than miraculous. While I shall do everything in my power to be equal to it, I do not even now lose sight of the possibility that such may prove not to be the

case; and I wish you to understand clearly that the Institute is of infinitely more importance than I am, and that, in that event, I should be the first to wish this responsibility and opportunity transferred to another. I am in absolute earnest when I say that I expect from all those connected with it the most candid and fearless suggestion and criticism.

I have a similar conviction respecting the Board of Trustees. It is not the function of a board of trustees to be merely amiable. On the contrary, you have as distinct a responsibility as I, and I trust that this Board of Trustees, while realizing the limitations under which busy men and women necessarily serve in such capacities, may nevertheless feel themselves bound to hold up to a high standard of performance the officers to whom they have delegated duties and responsibilities. Here again my personal experience has been fortunate. For almost twenty years I was associated with a body whose activities touched many parts of the educational field in various sections of the country. The officers at the time I entered the organization were able, intelligent, and devoted, but the trustees were also active and critical, with the result that the performance of the General Education Board during its entire history has been infinitely to the credit of the founder, the officers, and the trustees.

I emphasized a moment ago the fact that insti-

tutions of learning are made up of men and women. In this complex modern civilization with its steadily rising standard of living it is of the first importance that education and research should attract gifted and vigorous talent. During the last twenty-five years the world has undergone great and important changes. Institutions of learning, once situated in quiet villages, now find themselves in the heart of busy and noisy cities. Men and women who a generation ago might have devoted themselves to academic life are swept into the vortex of practical life. Professor Seligman of Columbia University has recently said that the "outlook for brains in American universities is an ominous one." The sacrifices required of an American professor and his family are to a high degree deterrent. The conditions provided are rarely favorable to severe, prolonged, and fundamental thinking. Poor salaries frighten off the abler and more vigorous and compel the university instructor to eke out his inadequate income by writing unnecessary textbooks or engaging in other forms of hack work. I do not need to argue that, despite individual exceptions, American scholarship cannot be promoted upon an unsound and unsatisfactory economic basis. It is therefore of the utmost importance that we should set a new standard. We do not need a large faculty. We should endeavor to attract into the Institute a small number of

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scholars and scientists who will be free from financial worry and concern, who will live and work amidst conditions favorable to intellectual activity. A professorship can of course never be as remunerative as the practice of law or medicine or a successful career in business. It need not be, for it has much to offer that neither law nor medicine nor business can offer. But, on the other hand, the German universities long ago proved that adequate remuneration with sufficient leisure amidst attractive and congenial living conditions and associations are absolutely necessary to the upbuilding of an academic group. I hope therefore that in these matters, upon which our success depends, I may count on the concurrence of the Board, to the end that whether we invite persons to be associated with us temporarily or permanently, the inducement and the conditions will attract the most vigorous and the best endowed minds of our generation.

With these few and very general statements I venture in your name to thank the founders of this new institution and to express the hope that this may prove an auspicious day in the history of higher education in the United States.



*Confidential Memorandum to the Trustees  
of the  
Institute for Advanced Study*

September 26, 1931



C O N F I D E N T I A L

To the Trustees of the Institute for Advanced Study:

Following the publication in December, 1930, of Bulletin No. 1, entitled "Organization and Purpose", I spent the better part of six months in conference with the leading scholars of America and the main European countries, seeking to elicit their critical opinion as to the value of the proposed Institute and their constructive suggestions as to the initial steps to be taken. I encountered no difference of opinion as to the importance of creating an institute of the proposed character and scope; and this, because, in the last half century, universities have everywhere undergone changes that have impaired their fundamental and essential character. The topics respecting which most discussion took place were the subjects which the Institute should first attack, the persons best qualified to lead, the conditions under which they would work most effectively, the location and ultimate character of the buildings. All these knotty questions need not be decided at once. On one or two of them my mind has become clear, as will be made plain in the course of this report; as to the others, further conference and reflection are still requisite.

I

In the interest of clarity, let me begin by recapitulating the reasons why the Institute for Advanced Study has been established and what its main characteristics should be; for only by recapitulation from time to time can we be sure that we will not be drawn or drift out of our course. Universities, being primarily intellectual in character, ought to be small and plastic; they should be havens where scholars and scientists may regard the world and its phenomena as their laboratory, without being carried off by the maelstrom; they should be simple, comfortable, quiet without being



monastic or remote; they should be afraid of no issue; yet they should be under no pressure from any side which might tend to force their scholars to be prejudiced either for or against any particular solution of the problems under study; and they should provide the facilities, the tranquillity, and the time requisite to fundamental inquiry. Now, current tendencies almost all run in the opposite direction: universities have with startling suddenness become big; having become big, they have lost plasticity; they are so big that in every direction they are pressed for funds; they have had to be organized as business is organized, which is precisely the type of organization that is inimical to the purposes for which universities exist and unpleasant to the type of person needed to promote science and scholarship; they have been dragged into the market place; they have been made to serve scores of purposes - some of them, of course, sound in themselves - which universities cannot serve without abandoning purposes which they and no other institution can serve at all. "It is the multiplicity of its purposes that makes an American university such an unhappy place for a scholar", writes one of my correspondents. Instead of limiting themselves to fundamental inquiries which may in the long run assist in the solution of complex problems, universities have almost without exception also engaged in training immature and unprepared boys and girls for practical tasks which are merely matters of the moment. Instead of providing absolute independence of speech and thought for mature men conscious of their vast responsibilities, universities have generally - though exceptions may be found - pursued two courses: emitted superficial utterances which only add to the existing Babel or avoided delicate and controversial issues, particularly in the social and economic realms. A repressive, often an unconsciously repressive influence, has emanated from trustees or executive officers. Scholarship does not prosper under the conditions I have briefly enumerated. In the entire course of my travels thus far,

I have encountered no one who felt that the present conditions of university life are favorable to sound thinking and contemplative living, though, to be sure, instances in abundance can be cited in which individuals have created or have insisted upon obtaining for themselves special terms which make their portion tolerable.

The suggestions that the Institute for Advanced Study should be small, that its staff and students or scholars should be few, that administration should be inconspicuous, inexpensive, subordinate, that members of the teaching staff, while freed from the waste of time involved in administrative work, should freely participate in decisions involving the character, quality, and direction of its activities, that living conditions should represent a marked improvement over contemporary academic conditions in America, that its subjects should be fundamental in character, and that it should develop gradually - on these suggestions there was on both sides of the Atlantic unanimous agreement.

To my request for constructive ideas, the response was different. Men knew more or less clearly what they would like or needed; but as no one had supposed that an institution of the kind described was likely to be established, no one was prepared to be definite in his immediate recommendations. In informal talk, often occupying many hours, we browsed over the whole field; frequently, before we parted, I was promised a memorandum which would embody deliberate observations as to procedure, personnel, subjects, etc. In what I now write, I am drawing upon these informal conferences, upon such notes and reflections, as I made at the time and subsequently, and upon the memoranda which have come to me from America, England, France, Germany, and Italy. I am indebted, very deeply indebted to all who gave me freely of their time, thought, and experience; and yet I should be at a loss to assign responsibility, if I were asked as to any particular item.

## II

I have already reviewed the differences between existing universities and the Institute founded by Mr. Bamberger and Mrs. Fuld. Let me now draw a line between the Institute for Advanced Study, as I conceive it, and a research institute. The Institute for Advanced Study will, of course, by reason of its constitution and conception be a research institute; if the members of its staff are not contributors to the progress of knowledge and the solution of problems, there is no sufficient reason for setting it up; but they will also be teachers, men who have chosen a few competent and earnest disciples engaged in the mastery of a subject, precisely as the pupils of all the great masters of the last century - of Clerk Maxwell, Michael Foster, and Vinogradoff in England, of Claude Bernard or Halévy in France, of Helmholtz, Ludwig, and Wilamowitz in Germany - were in the first instance concerned to learn thoroughly physics, physiology, institutions, or Greek, as the case might be. Teaching should, however, be informal; for, if formal, mechanism will be devised; its burden should be light, for, if it is heavy, the teacher has too many pupils or the pupils are unfit. And the students may at times be investigators too, though not prematurely at the price of mastering their subjects.

In the so-called "research institutes" teaching is, of course, also carried on, though in somewhat different fashion. The members of a research institute are also learners, whatever else they be. And yet the emphasis is different, for the research institute is primarily concerned with problems, very specific problems, as a rule; and young men enter either as assistants to older workers or as novices to be tried out by time. The Institute for Advanced Study will be neither a current university, struggling with diverse tasks and many students, nor a research institute, devoted solely to the solution of problems. It may be pictured as a wedge inserted between the two -

a small university, in which a limited amount of teaching and a liberal amount of research are both to be found. Persons who require to be drilled or taught hard do not belong within the Institute for Advanced Study. The level of the teaching and its form mark it off sharply from college teaching, from most university teaching, from technological or professional teaching. This granted, the professor himself benefits, if for an hour or two weekly, in addition to his own research and the supervision of a few investigations, he discusses with a small thoroughly competent body a larger theme. He is thus assisted in preserving his own perspective, and he has a motive for wider reading and broader contacts.

If I may endeavor to visualize the Institute tentatively, I should think of a circle, called the Institute for Advanced Study. Within this, I should, one by one, as men and funds are available - and only then - create a series of schools or groups - a school of mathematics, a school of economics, a school of history, a school of philosophy, etc. The "schools" may change from time to time; in any event, the designations are so broad that they may readily cover one group of activities today, quite another group, as time goes on. Thus, from the outset the school of mathematics may well contain the history or philosophy of science; the school of economics, a chair of law or political theory. Each school should conduct its affairs in its own way; for neither the subjects nor the scholars will all fit into one mould. An annually changing chairman would perhaps be the only officer requisite. There should be complete academic freedom as there is in England, France, and Germany. We are, let it be remembered, dealing with seasoned and, I hope, eminent scholars, who must not be seriously or long diverted from creative work. These men know their own minds; they have their own ways; the men who have, throughout human history, meant most to themselves and to human progress have usually followed their own inner light; no organizer,

no administrator, no institution can do more than furnish conditions favorable to the restless prowling of an enlightened and informed human spirit, seeking its intellectual and spiritual prey. Standardization and organization do not aid: they are simply irksome.

### III

Delicate questions arise in connection with the relations which should exist between director, staff, and trustees. Incidentally I have touched on them in saying that, as a matter of course, the staff will be made up of mature scholars, presumably conscious of the weight that should attach to their utterances and actively participating in the government of the Institute. But the subject is a difficult one, and I am not yet prepared to submit further positive recommendations, though it has received my continuous attention. I am clear that the relationship between the executive officers and the faculty is not usually in America cordial or satisfactory. On the contrary, for one reason or another, the American professorate is unhappy - and it will not enlist the country's best brains in sufficient number until the atmosphere is radically changed. I have already suggested changes of a fundamental character, among them the inclusion in the board of trustees of outside scholars as well as members of its own staff. Whether this is all that need be done to give learning its proper weight in the Institute, I am not at this moment prepared to say. I do say, however, that the Institute exists for the sake of learning and that policies and measures that are inimical to the happy and enthusiastic pursuit of learning are necessarily wrong. It has been urged that trustees should limit their activities to business matters and that faculties should govern all else. In support of this contention Germany, France, Oxford and Cambridge are cited. But none of these instances is convincing. In Germany, a powerful ministry is in constant cooperation, as it is in occasional conflict with the universities; practically the same is true in France, where,

however, the bureaucratic habit is stronger; Oxford and Cambridge do indeed govern themselves, but on three occasions in the last half century Parliament has intervened through Royal Commissions in order to cure some of the defects due to government by exclusively academic bodies. The results of the last Royal Commission were so unsatisfactory that a voluntary commission composed of scholars and laymen has now undertaken the study of the entire problem and has published the first of its reports. Both lay trustees, alone, and teachers, alone, are liable to be one-sided. When the president is the sole link or channel of communication between the staff or trustees, he tends to be autocratic and is unlikely to be widely informed. Our American experience shows the consequences. On the other hand, faculty government would distract scholars and might lead to internal and factional difficulties. We have, as I have said, tried to correct these weaknesses by constituting the Board of Trustees of the Institute out of laymen, academic personages not members of the Institute, and persons chosen from the Institute staff. Thus every relevant point of view should get a hearing. At present, this arrangement will, I believe, suffice. Further steps can be taken, if problems arise, for the solution of which this simple organization is inadequate. I fear, however, that mere organization and rules will not alone achieve our purpose - that of creating a genuine seat of learning. Sympathy, helpfulness, and mutual respect, involving director, trustees, and faculty are all requisite to create an atmosphere free of tension, attractive to men of high attainments and to students of unusual ability.

The schools composing the Institute should each select and admit its own students; no registration office is needed, for under existing academic conditions in America the possession of a diploma or degree does not indicate whether its owner is fit or unfit for advanced study. They must be discovered by any means calculated to locate them. Such students do indeed exist in

America in considerable numbers; but they are not easily found, for already universities bid against each other for them either by offering fellowships freely or by offering part-time employment. I am sure that employment as assistant at this stage of the student's progress is wrong: in a recent report the President of Harvard deploras the fact that of the graduate students of Harvard University 56% are now "part-time". I should urge that students be as a rule full-time, though I can conceive of circumstances and conditions which may justify the admission of a thoroughly competent and highly advanced student also otherwise engaged, that fellowships, grants, or more often loans be available for persons of distinctly unusual gifts and promise who cannot otherwise pursue their studies under proper conditions, and that reasonable fees be charged in other cases. The budget and the program should be so carefully controlled that the Institute will for some years at least be independent of receipts from fees. The precise manner of making the annual budget can be determined somewhat later; I am clear that the Institute should not annually spend its entire income, that it should undertake nothing involving a deficit, a procedure that is all too common and with disastrous results. Tentatively each school may work out its budget, and the several budgets can perhaps be harmonized in conferences between the director and the several schools, in preparation for consideration, first, by a budget committee of the Board of Trustees, consisting, perhaps, as at the Rockefeller Institute for Medical Research, of three scholars and two laymen, and finally by the Board as a whole.

#### IV

No requirements are needed as to the maximum or minimum number of hours or years that the student must or may work, neither as to majors or minors requisite to the attainment of a degree, and we can determine experimentally problems such as the length and arrangement of terms. There will be excellent students who will work in one way; equally excellent students who

will work quite differently. Subjects or fields do not have to be "covered" - cannot be, at a high level. In his own time, the student may show that he has mastered his subject, without which mastery the Institute should give him no mark of approval. He may perhaps, in addition thereto, have done what the Germans call an "Arbeit"; if so, he can be further distinguished. But in any case the numbers will be so small that professor and students will know one another intimately; machinery will be superfluous; arrangements should vary from man to man, from year to year, from subject to subject. The highest possible standard of both general and special education should be insisted on: so much the founders proposed in their first letter to the Trustees.

#### V

In this connection I wish to guard against a misinterpretation of the term, "schools". I have said that it is to be loosely interpreted. I may now add that it involves no particular theory as to how knowledge is to be advanced. In America, one is told time and again that knowledge must be "correlated", that "team-work" is essential. Now there is no question that scholars rely upon one another, as they rely upon the long history of which they are endeavoring to forge a new link. But great scholars, scientists, and philosophers may be mentioned, who, while leaning upon the past, did their fundamental thinking alone - Kant, Newton, Faraday, Darwin, Henry, and more recently Einstein, who has latterly said:

"I am a horse for single harness, not out out for tandem or team work; for well I know that in order to attain any definite goal, it is imperative that one person should do the thinking and commanding and carry most of the responsibility. But those that are led should not be driven, and they should be allowed to choose their leader."

While, therefore, I am of the opinion that the Institute as a teaching body can probably best function if the representatives of a given subject meet and discuss their common interests as a school, I should also allow every



individual and every school or group to pursue the methods that seem to him or to them best. Between men of first-rate ability collaboration or team work cannot be arranged or forced; on the other hand, collaboration and discussion will take place, where a relatively small group of scholars have abundant opportunity to discuss with one another either their own individual problems or problems that lie on the border line.

In course of time, the buildings may be so conceived and executed as to facilitate intercourse of this type. I have in mind the evolution that in the process of centuries has taken place at All Souls College, Oxford, where, as in the proposed Institute, there are no undergraduate students, and where advanced students and the older Fellows live under ideal conditions, whether for their individual work or for collaboration and cooperation. No one planned all this. It grew up because scholars were left free to work out their own salvation. It cannot be imitated or taken over; but it is there, as evidence that the thing can be done, if the pace is not forced and if the hand of the executive and administrator touches but lightly the growing organism. There is a school of mathematics, let us say, made up of mathematicians; but the mathematicians will lunch, smoke, chat, walk, or play golf with the physicists; can any possible form of organization give the flexibility, the intimacy, the informality, the stimulus thus attainable? No "director" or "departmental head" or "executive" needs to worry for fear that independent or water-tight groups, ignorant of one another, will form or not form. If the spirit of learning animates the Institute - and without that there is no reason for its existence - men will talk together and work together, because they live together, have their recreation together, meet on the same humane social level, and have a single goal.

## VI

In my opinion, every step taken in forming the Institute should be

viewed as experimental. And this will be easy, if the Institute is kept small and if its quality is securely guarded. To the question of what subjects or schools to start with I have given much attention; and I have profited by judgment and advice obtained from many sources. I assume at the outset that no subject will be chosen or continued unless the right man or men can be found. Subject to this reservation, never to be forgotten, a very vague statement is contained in Bulletin No. 1. I can be somewhat more definite now, though retaining liberty to change up to the very moment when action is resolved upon. The decision not to begin with the physical or biological sciences has become stronger; they are already better done than other subjects; moreover, they are creating problems with which universities are not now dealing competently. Finally, they are not at the very foundation of modern science. That foundation is mathematics; and it happens that mathematics is not a subject in which at present many American universities are eminent. Mathematics is the severest of all disciplines, antecedent, on the one hand, to science, on the other, to philosophy and economics and thus to other social disciplines. With all its abstractness and indifference both pure and applied scientific and philosophic progress of recent years has been closely bound up with new types and methods of sheer mathematical thinking.

In behalf of mathematics, other things are to be said in addition to the fact that it is both fundamental and severe. It has, to be sure, uses, as all the higher activities of the human mind have uses, if the word, "use", is broadly and deeply understood. But its devotees are singularly unconcerned with use, most of all with immediate use, and this state of mind and spirit, it seems to me, ought to dominate the new Institute. Nothing is more likely to defeat itself, nothing is on the whole less productive in the long run than immediacy in the realm of research, reflection, and contemplation. The men who have moved the world have usually been men who have followed the will o' the

wisp of their own intellectual and spiritual curiosity. If we can make the Institute a congenial home for those who are curious in this sense, it will have its effect. On the other hand, there exists the precisely opposite type of mind - the mind that derives its initial stimulus from a practical need or problem. Lavoisier, the founder of modern chemistry, is said to have been started on his road by the need of improving the lighting of the streets of Paris; and Justice Holmes has shown that a great political philosopher can find his text and starting point in purely practical problems that arise in administering the law. Pasteur, Lister, Koch, Ehrlich, and an unending row of physicists and chemists have their feet in both worlds - the world of practice and the world of theory. Minds that are fundamental in their searching, whatever the spring that moves them - curiosity, pity, imagination, or practical sense - all belong in an institute for advanced study.

Now mathematics is singularly well suited to our beginning. Mathematicians deal with intellectual concepts which they follow out for their own sake, but they stimulate scientists, philosophers, economists, poets, musicians, though without being at all conscious of any need or responsibility to do so. Moreover, it is no small, though an accidental and incidental advantage, at a time when we wish to retain plasticity and postpone acts and decisions that will bind us, that mathematics is the simplest of subjects to begin with. It requires little - a few men, a few students, a few rooms, books, blackboard, chalk, paper, and pencils. Let us endeavor, therefore, to bring together a fertile mathematical group; let us provide for them ideal conditions of work. In due course, provision can be made for mathematical physics, and the door thus opened for another step forward when conditions are ripe; and for statistics, which will open a door on the other side.

At the same time, assuming that funds are adequate and that the right persons can be secured, I am now inclined to include economics. It is, as I

have intimated, linked to mathematics by statistics. In other respects, it seems to be everything that mathematics is not, for it is obviously of the world of action, rather than the world of sheer thought. But there are grave reasons for this choice. There is no more important subject than the evolution of the social organism, and the social organism is developing now as never before under the pressure of economic forces. Before our very eyes, mankind is conducting portentous social-economic experiments. Science and philosophy are creating new means and new goals; the economist must have something to say as to their value and feasibility. Almost half a century ago, while still a Massachusetts judge, Justice Holmes declared: "The man of the future is the man of statistics and the master of economics." But where does the economist enjoy the independence and the leisure which have for a century been enjoyed by the philosopher and the physicist? Where is the economist who is by turns a student of practice and a thinker - in touch with the realities, yet never their slave? At present, economists too often live from day to day, from hand to mouth; a professor, a journalist, a handyman for banks and business men. Economics, hard pressed by the tasks of the day, has not usually enlisted minds willing to work in leisurely and philosophic fashion. Hence, in part, its failures and disappointments. Half-baked ideas, experiments, recommendations flood the world; economists are simultaneously expected to be investigators, journalists, advisers, forecasters, and what not. Not infrequently, the source of their income may impair the soundness or reliability of their judgment. Nowhere does a group of economists enjoy the conditions which Pasteur enjoyed, when he was working out the foundations of preventive medicine, or Helmholtz, Clerk Maxwell, and Rowland, when they were working out the foundations of modern physics.

Time was, when Europe was exposed to ravage by typhus or bubonic plague. Their origin and progress were shrouded in mystery; but the veil has

now been lifted; these plagues will not recur, because their causes and methods of distribution are understood; they can be prevented or stopped. But from social and economic plagues the world is not yet immune. They continue to come and go mysteriously. We cannot any longer sit helpless before these social and economic plagues, which, once well under way, ravage the world, as our present economic and social perplexities and sufferings show. The very conquests which science has wrought - increased production and easier distribution, which ought to be blessings - have drawn in their wake curses that may or may not be connected with them. On these intricate and recondite matters I have no opinion; but clear it is that nowhere in the world does the subject of economics enjoy the attention that it deserves - economics in the broad sense, inclusive of political theory, ethics, and other subjects that are involved therein. The Institute for Advanced Study has here a pressing opportunity; and assuredly at no time in the world's history have phenomena more important to study presented themselves. For the plague is upon us, and one cannot well study plagues after they have run their course; for with the progress of time it is increasingly difficult to recover data, and memory is, alas, short and treacherous.

Thus I conceive a group of economists and their associates, financially independent, unhurried, and disinterested, in closest possible contact with the phenomena of business and government and at this high level endeavoring to understand the novel phenomena taking place before our eyes. The mathematician is in a sense secure from immediacy; the economist must be made so. He has at times to mingle in the stream of life; we must make it safe for him to do so. He must be enabled to take the same attitude towards social phenomena that the medical scientist has now been enabled to take towards disease. Not even the practical man need be concerned as to the good of this sort of work. The late Professor Starling, discussing discovery and research, said wisely:

"The preparation of insulin by Banting and Best, an admirable piece of work, is but the last step of an arduous journey, in which hundreds of workers have taken part. There is no need to be concerned about 'discoveries'. It is only necessary to ensure that the growing tree of knowledge is dug round and pruned and watered."

Beyond these two schools, I do not now look, though it is obvious how readily history and other schools - literature, music, or science - can be added when money, men, and ideas are available. I am opposed to making a "small beginning" in other subjects that will soon create a deficit on the theory - mistaken, as I think - that, if the pressure becomes acute enough, funds can somehow be obtained for necessary expansion. Experience shows that under such conditions the head of an institution must become a money-getter and that the university itself may lose its freedom in certain directions. I favor, as I have already said, financial, administrative, and educational methods that will leave a surplus, not create a deficit. Thus the Institute will be enabled to pursue a policy analogous to that of the Collège de France, viz., to take advantage of surprises by creating from time to time a chair for a new subject or an unexpected person. By the same token, not being concerned with subjects or degrees in the ordinary sense, chairs that have served their purpose can be discontinued. In these respects the stimulating influence of the Collège de France has proved of incalculable value. It has pioneered in every direction, even in medicine, in which, while never attempting the formation of a faculty, it has furnished chairs and laboratories for some of the greatest of medical scientists. Under such circumstances, growth will be slow and unsymmetrical, as it should be; for, if growth is slow, we shall learn much from experience - much that will be helpful in reshaping such schools as we start, much that will be helpful in shaping others; and, if the Institute is unsymmetrical, it can the more readily remain elastic and highly vitalized.

## VII

Scholarly groups such as I have described are not readily procurable. The war destroyed many persons who would have been eligible; the unsatisfactory economic status of teaching surely deters others. None the less, the conditions to be offered will, I believe, attract some American scholars of high rank; they will certainly attract, for varying, but always sufficiently long periods, distinguished foreigners. Foreigners often find it so difficult to accommodate themselves to our usual type of academic organization that they are hardly more than decorative. I suspect that, in the Institute, as above described, they will feel themselves "at home". In the great days of the early Hopkins, President Gilman "borrowed" and recommended "borrowing". I am hopeful that "borrowing" for periods long enough to be telling may become a recognized feature of the new Institute. Because of the increased cost of living and travel, students, unless financed by outside agencies, can no longer wander as freely as they did half a century ago; it may be at times easier to reverse the process by bringing the professor to the students rather than to send the students to the professor. It is, however, also important that the director and the staff should from time to time visit other institutions in this country and Europe. Foreign scholars and scientists, living, as they do, in easy reach, know one another personally. The American scholar or scientist travels relatively little; neither he nor his university can afford the expense. Yet nothing is more stimulating - or in the long run more economical - than personal contacts. How can the head of a university judge wisely, if he has not for a generation been in touch with scholars and scientists, if he does not keep in close and constant contact with scholars and scientists, on the one hand, and with the real world, on the other? Business men know better; they are constant first-hand students of their competitors; on this point an institute for advanced study can certainly learn something important from industry.

## VIII

I have from the start insisted that in nothing can the new Institute do a better service or exert a more wholesome influence than by placing its staff on a sound economic basis. The professor is not in competition with professional or business life; the income of a busy lawyer or doctor or business man would harm, not help, him. He must be so devoted to learning that he would be willing for its sake to endure hardship and deprivation. All too frequently he has done and is doing so. But it does not follow that, because riches may harm him, comparative poverty aids him. His needs are relatively simple, though, such as they reasonably are, they should be amply satisfied; and a contributory pension scheme should be open to all connected with the Institute. It does not help the clarity or concentration of a man's thinking, if he is oppressed by the fear of a needy or precarious old age, if on retirement his scale of living, already none too lavish, has to be suddenly reduced, if his wife is compelled to forgo domestic help, if his children are deprived of liberal educational opportunities, if he lives in cramped quarters, if he lacks privacy, books, music, or travel, if he is led either to marry for money or to forgo the raising of a family, if a gap - social or financial - exists between the administrative and executive heads, on the one hand, and the scholar, on the other. Nor is the university assisted, if a low scale of remuneration draws to its staff mainly mediocre or part-time workers, forced to increase their income by splitting their energy and attention. Younger men, still on trial, may be decently remunerated without danger, provided their terms of service are definitely limited. We shall open a new era in education, if our salaries indicate that, whatever his importance, not the administrator, but the faculty, creates a university. Surely the nation which has built palaces for libraries, laboratories, and students will not permanently ignore the professor who is in truth the university itself. For, as life becomes more complicated, the university



becomes more and more important; into its chairs an ever larger share of brains and devotion must be drawn. Under what conditions will this take place? It is our duty to ascertain them and to meet them. But such a scale of remuneration is not a one-sided affair; it pledges the professor to devote his whole time to the university and to avoid gainful activities. Should this policy be accepted, as in my opinion it must, the entire faculty of an American institution will thus be placed on a full-time basis; real academic freedom - the freedom to work unworried and unhampered - will be attained. Under such circumstances, the professor of economics may elect to study thorny and contentious financial, business, or social problems; he can take his time in so doing; whatever his conclusions, his intellectual integrity is not likely to be impaired or impugned. On this basis alone can a university or an institute be in the world and of the world, as far as any individual may desire, and yet preserve its absolute independence and freedom of thought and speech.

## IX

The success of the Institute will in the slow processes of time be measured by the development of its staff, the students that it trains, and the additions that it makes to the world's fund of knowledge and experience. For the future of its students it need take little thought; their number will be limited; they will find their level. Additions to knowledge take the form of papers, books, and occasional addresses. Many American universities maintain their own presses. They may in some cases be justified in so doing; but the Institute for Advanced Study needs no press. A university press is a business; if possible, it must pay a profit - at least, it must endeavor to carry itself. In either event, it usually publishes what will sell - sometimes worth-while books and pamphlets, often books and pamphlets that had far better remain unprinted; it shrinks from publications that appeal to a small circle of readers and students, though from a university point of view such publications may be

of prime importance. I favor a strict policy in respect to publication. "Viel arbeiten, wenig publizieren", Ehrlich used to say. Let us hold to a high standard of performance as to both form and content. When a paper deserves publication, there will usually be a place for it; if a larger work merits printing, it can easily be handled, provided the actual outlay is underwritten. Thus university organization will be simplified; money will be saved; distribution will be more skilfully managed. Publicity need not be sought: if the Institute succeeds, the real problem will be how to avoid or restrict it.

I have said nothing definite thus far as to buildings and site, and that because despite their crucial importance these things come second. Nevertheless, they cannot be ignored. A group of scholars should not be isolated; they need access to libraries, museums, collections, and other scholars - the more so, because a slow development is contemplated. If the life of the academic body is to be normal and wholesome, the accessories of civilization must be obtainable with such means as they possess - I mean schools, physicians, friends, and domestic aid. "Association with other men like themselves", writes one who has thought deeply about the project, "will be agreeable and informed by the interests and graces of the mind. Life will be intensely active, but leisurely at the same time, as scholars and wise men know how to make life leisurely. When I contemplate the possibilities of leading life under such circumstances, I am filled with a deep enthusiasm and a vast yearning. If I am so moved, I cannot doubt that there must be countless other men who are moved by the same desires." It is not, in the first instance, a question of erecting buildings; for the subjects, with which I propose that we begin, any kind of buildings may be made to answer. In time, certain conditions affecting the site will require consideration. It should be large enough to be forever protected against the noise and bustle of urban or commercial life. But I have come to no conclusion on these points; I have merely been analyzing the problems in order to separate

the various factors. I shall suggest the appointment of a small committee which may make a preliminary study of this question with a view to general discussion by the Board later.

Certain topics I have purposely omitted in this report. I have said nothing, for example, of the duties of the director. These are described in general terms in the By-Laws; to this description, nothing needs at this moment be added. For the same reason I have not touched on details of business management; for the present they can continue to be carried by cooperation between the treasurer and the assistant secretary. Many persons raise the problem of a library; but the library problem depends partly on location; partly it will be solved by equipping with books the several schools; out of these, by the mere process of addition, the Institute library will ultimately grow. I have proposed nothing definite as to fees or the terms on which degrees will be conferred: both subjects ought to be discussed by the Committee on Education which cannot be formed until the first staff appointments are made.

In closing, let me say that I am not unaware of the fact that I have sketched an educational Utopia. I have deliberately hitched the Institute to a star; it would be wrong to begin with any other ambition or aspiration. On the other hand, I have been careful to keep within the realm of the practical. But I do not deceive myself; it will not be easy even to begin on any such basis; it will be harder, as the years pass, to keep to this standard. We shall find ourselves dealing with men and women, not with angels or super-men. Difficulties will arise; disappointments will occur. But we shall be helped, not harmed, by the high level at which we have pledged ourselves to act. In any case, unless we attempted something much higher than is now attained, there would be little reason to attempt anything at all.

## X

For the present, I ask no final action on this report. I hope only that it may be freely discussed. On several important matters, I desire to seek further counsel. When the time is ripe, I shall ask the Board for authority to proceed. Meanwhile, I wish to feel free to alter it in the light of such further knowledge as I may obtain.

Abraham Flexner

Sept. 26, 1931.



*The Usefulness of Useless Knowledge*

by

Abraham Flexner

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## THE USEFULNESS OF USELESS KNOWLEDGE

BY ABRAHAM FLEXNER

IS IT not a curious fact that in a world steeped in irrational hatreds which threaten civilization itself, men and women—old and young—detach themselves wholly or partly from the angry current of daily life to devote themselves to the cultivation of beauty, to the extension of knowledge, to the cure of disease, to the amelioration of suffering, just as though fanatics were not simultaneously engaged in spreading pain, ugliness, and suffering? The world has always been a sorry and confused sort of place—yet poets and artists and scientists have ignored the factors that would, if attended to, paralyze them. From a practical point of view, intellectual and spiritual life is, on the surface, a useless form of activity, in which men indulge because they procure for themselves greater satisfactions than are otherwise obtainable. In this paper I shall concern myself with the question of the extent to which the pursuit of these useless satisfactions proves unexpectedly the source from which undreamed-of utility is derived.

We hear it said with tiresome iteration that ours is a materialistic age, the main concern of which should be the wider distribution of material goods and worldly opportunities. The justified outcry of those who through no fault of their own are deprived of opportunity and a fair share of worldly goods therefore diverts an increasing number of students from the studies which their fathers pursued to the equally important and no less urgent study of social, economic, and govern-

mental problems. I have no quarrel with this tendency. The world in which we live is the only world about which our senses can testify. Unless it is made a better world, a fairer world, millions will continue to go to their graves silent, saddened, and embittered. I have myself spent many years pleading that our schools should become more acutely aware of the world in which their pupils and students are destined to pass their lives. Now I sometimes wonder whether that current has not become too strong and whether there would be sufficient opportunity for a full life if the world were emptied of some of the useless things that give it spiritual significance; in other words, whether our conception of what is useful may not have become too narrow to be adequate to the roaming and capricious possibilities of the human spirit.

We may look at this question from two points of view: the scientific and the humanistic or spiritual. Let us take the scientific first. I recall a conversation which I had some years ago with Mr. George Eastman on the subject of use. Mr. Eastman, a wise and gentle far-seeing man, gifted with taste in music and art, had been saying to me that he meant to devote his vast fortune to the promotion of education in useful subjects. I ventured to ask him whom he regarded as the most useful worker in science in the world. He replied instantaneously: "Marconi." I surprised him by saying, "Whatever pleasure we



derive from the radio or however wireless and the radio may have added to human life, Marconi's share was practically negligible."

I shall not forget his astonishment on this occasion. He asked me to explain. I replied to him somewhat as follows:

"Mr. Eastman, Marconi was inevitable. The real credit for everything that has been done in the field of wireless belongs, as far as such fundamental credit can be definitely assigned to anyone, to Professor Clerk Maxwell, who in 1865 carried out certain abstruse and remote calculations in the field of magnetism and electricity. Maxwell reproduced his abstract equations in a treatise published in 1873. At the next meeting of the British Association Professor H. J. S. Smith of Oxford declared that 'no mathematician can turn over the pages of these volumes without realizing that they contain a theory which has already added largely to the methods and resources of pure mathematics.' Other discoveries supplemented Maxwell's theoretical work during the next fifteen years. Finally in 1887 and 1888 the scientific problem still remaining—the detection and demonstration of the electromagnetic waves which are the carriers of wireless signals—was solved by Heinrich Hertz, a worker in Helmholtz's laboratory in Berlin. Neither Maxwell nor Hertz had any concern about the utility of their work; no such thought ever entered their minds. They had no practical objective. The inventor in the legal sense was of course Marconi, but what did Marconi invent? Merely the last technical detail, mainly the now obsolete receiving device called coherer, almost universally discarded."

Hertz and Maxwell could invent nothing, but it was their useless theoretical work which was seized upon by a clever technician and which has created new means for communication, utility, and amusement by which men whose merits are relatively slight have obtained fame and earned millions. Who were the useful men? Not Marconi, but Clerk Maxwell and Heinrich Hertz. Hertz

and Maxwell were geniuses without thought of use. Marconi was a clever inventor with no thought but use.

The mention of Hertz's name recalled to Mr. Eastman the Hertzian waves, and I suggested that he might ask the physicists of the University of Rochester precisely what Hertz and Maxwell had done; but one thing I said he could be sure of, namely, that they had done their work without thought of use and that throughout the whole history of science most of the really great discoveries which had ultimately proved to be beneficial to mankind had been made by men and women who were driven not by the desire to be useful but merely the desire to satisfy their curiosity.

"Curiosity?" asked Mr. Eastman.

"Yes," I replied, "curiosity, which may or may not eventuate in something useful, is probably the outstanding characteristic of modern thinking. It is not new. It goes back to Galileo, Bacon, and to Sir Isaac Newton, and it must be absolutely unhampered. Institutions of learning should be devoted to the cultivation of curiosity and the less they are deflected by considerations of immediacy of application, the more likely they are to contribute not only to human welfare but to the equally important satisfaction of intellectual interest which may indeed be said to have become the ruling passion of intellectual life in modern times."

## II

What is true of Heinrich Hertz working quietly and unnoticed in a corner of Helmholtz's laboratory in the later years of the nineteenth century may be said of scientists and mathematicians the world over for several centuries past. We live in a world that would be helpless without electricity. Called upon to mention a discovery of the most immediate and far-reaching practical use we might well agree upon electricity. But who made the fundamental discoveries out of which the entire electrical development of more than one hundred years has come?

The answer is interesting. Michael Faraday's father was a blacksmith; Michael himself was apprenticed to a bookbinder. In 1812, when he was already twenty-one years of age, a friend took him to the Royal Institution where he heard Sir Humphrey Davy deliver four lectures on chemical subjects. He kept notes and sent a copy of them to Davy. The very next year, 1813, he became an assistant in Davy's laboratory, working on chemical problems. Two years later he accompanied Davy on a trip to the Continent. In 1825, when he was thirty-four years of age, he became Director of the Laboratory of the Royal Institution where he spent fifty-four years of his life.

Faraday's interest soon shifted from chemistry to electricity and magnetism, to which he devoted the rest of his active life. Important but puzzling work in this field had been previously accomplished by Oersted, Ampère, and Wollaston. Faraday cleared away the difficulties which they had left unsolved and by 1841 had succeeded in the task of induction of the electric current. Four years later a second and equally brilliant epoch in his career opened when he discovered the effect of magnetism on polarized light. His earlier discoveries have led to the infinite number of practical applications by means of which electricity has lightened the burdens and increased the opportunities of modern life. His later discoveries have thus far been less prolific of practical results. What difference did this make to Faraday? Not the least. At no period of his unmatched career was he interested in utility. He was absorbed in disentangling the riddles of the universe, at first chemical riddles, in later periods, physical riddles. As far as he cared, the question of utility was never raised. Any suspicion of utility would have restricted his restless curiosity. In the end, utility resulted, but it was never a criterion to which his ceaseless experimentation could be subjected.

In the atmosphere which envelopes the world to-day it is perhaps timely to em-

phasize the fact that the part played by science in making war more destructive and more horrible was an unconscious and unintended by-product of scientific activity. Lord Rayleigh, president of the British Association for the Advancement of Science, in a recent address points out in detail how the folly of man, not the intention of the scientists, is responsible for the destructive use of the agents employed in modern warfare. The innocent study of the chemistry of carbon compounds, which has led to infinite beneficial results, showed that the action of nitric acid on substances like benzene, glycerine, cellulose, etc., resulted not only in the beneficent aniline dye industry but in the creation of nitroglycerine, which has uses good and bad. Somewhat later Alfred Nobel, turning to the same subject, showed that by mixing nitro-glycerine with other substances, solid explosives which could be safely handled could be produced—among others, dynamite. It is to dynamite that we owe our progress in mining, in the making of such railroad tunnels as those which now pierce the Alps and other mountain ranges; but of course dynamite has been abused by politicians and soldiers. Scientists are, however, no more to blame than they are to blame for an earthquake or a flood. The same thing can be said of poison gas. Pliny was killed by breathing sulphur dioxide in the eruption of Vesuvius almost two thousand years ago. Chlorine was not isolated by scientists for warlike purposes, and the same is true of mustard gas. These substances could be limited to beneficent use, but when the airplane was perfected, men whose hearts were poisoned and whose brains were addled perceived that the airplane, an innocent invention, the result of long disinterested and scientific effort, could be made an instrument of destruction, of which no one had ever dreamed and at which no one had ever deliberately aimed.

In the domain of higher mathematics almost innumerable instances can be cited. For example, the most abstruse

mathematical work of the eighteenth and nineteenth centuries was the "Non-Euclidian Geometry." Its inventor, Gauss, though recognized by his contemporaries as a distinguished mathematician, did not dare to publish his work on "Non-Euclidian Geometry" for a quarter of a century. As a matter of fact, the theory of relativity itself with all its infinite practical bearings would have been utterly impossible without the work which Gauss did at Göttingen.

Again, what is known now as "group theory" was an abstract and inapplicable mathematical theory. It was developed by men who were curious and whose curiosity and puttering led them into strange paths; but "group theory" is to-day the basis of the quantum theory of spectroscopy, which is in daily use by people who have no idea as to how it came about.

The whole calculus of probability was discovered by mathematicians whose real interest was the rationalization of gambling. It has failed of the practical purpose at which they aimed, but it has furnished a scientific basis for all types of insurance, and vast stretches of nineteenth century physics are based upon it.

From a recent number of *Science* I quote the following:

The stature of Professor Albert Einstein's genius reached new heights when it was disclosed that the learned mathematical physicist developed mathematics fifteen years ago which are now helping to solve the mysteries of the amazing fluidity of helium near the absolute zero of the temperature scale. Before the symposium on intermolecular action of the American Chemical Society Professor F. London, of the University of Paris, now visiting professor at Duke University, credited Professor Einstein with the concept of an "ideal" gas which appeared in papers published in 1924 and 1925.

The Einstein 1925 reports were not about relativity theory, but discussed problems seemingly without any practical significance at the time. They described the degeneracy of an "ideal" gas near the lower limits of the scale of temperature. Because all gases were known to be condensed to liquids at the temperatures in question, scientists rather overlooked the Einstein work of fifteen years ago.

However, the recently discovered behavior of

liquid helium has brought the side-tracked Einstein concept to new usefulness. Most liquids increase in viscosity, become stickier and flow less easily, when they become colder. The phrase "colder than molasses in January" is the layman's concept of viscosity and a correct one.

Liquid helium, however, is a baffling exception. At the temperature known as the "delta" point, only 2.19 degrees above absolute zero, liquid helium flows better than it does at higher temperatures and, as a matter of fact, the liquid helium is about as nebulous as a gas. Added puzzles in its strange behavior include its enormous ability to conduct heat. At the delta point it is about 500 times as effective in this respect as copper at room temperature. Liquid helium, with these and other anomalies, has posed a major mystery for physicists and chemists.

Professor London stated that the interpretation of the behavior of liquid helium can best be explained by considering it as a Bose-Einstein "ideal" gas, by using the mathematics worked out in 1924-25, and by taking over also some of the concepts of the electrical conduction of metals. By simple analogy, the amazing fluidity of liquid helium can be partially explained by picturing the fluidity as something akin to the wandering of electrons in metals to explain electrical conduction.

Let us look in another direction. In the domain of medicine and public health the science of bacteriology has played for half a century the leading role. What is its story? Following the Franco-Prussian War of 1870, the German Government founded the great University of Strasbourg. Its first professor of anatomy was Wilhelm von Waldeyer, subsequently professor of anatomy in Berlin. In his *Reminiscences* he relates that among the students who went with him to Strasbourg during his first semester there was a small, inconspicuous, self-contained youngster of seventeen by name Paul Ehrlich. The usual course in anatomy then consisted of dissection and microscopic examination of tissues. Ehrlich paid little or no attention to dissection, but, as Waldeyer remarks in his *Reminiscences*:

I noticed quite early that Ehrlich would work long hours at his desk, completely absorbed in microscopic observation. Moreover, his desk gradually became covered with colored spots of every description. As I saw him sitting at work one day, I went up to him and asked what he

was doing with all his rainbow array of colors on his table. Thereupon this young student in his first semester supposedly pursuing the regular course in anatomy looked up at me and blandly remarked, "*Ich probiere.*" This might be freely translated, "I am trying" or "I am just fooling." I replied to him, "Very well. Go on with your fooling." Soon I saw that without any teaching or direction whatsoever on my part I possessed in Ehrlich a student of unusual quality.

Waldeyer wisely left him alone. Ehrlich made his way precariously through the medical curriculum and ultimately procured his degree mainly because it was obvious to his teachers that he had no intention of ever putting his medical degree to practical use. He went subsequently to Breslau where he worked under Professor Cohnheim, the teacher of our own Dr. Welch, founder and maker of the Johns Hopkins Medical School. I do not suppose that the idea of use ever crossed Ehrlich's mind. He was interested. He was curious; he kept on fooling. Of course his fooling was guided by a deep instinct, but it was a purely scientific, not an utilitarian motivation. What resulted? Koch and his associates established a new science, the science of bacteriology. Ehrlich's experiments were now applied by a fellow student, Weigert, to staining bacteria and thereby assisting in their differentiation. Ehrlich himself developed the staining of the blood film with the dyes on which our modern knowledge of the morphology of the blood corpuscles, red and white, is based. Not a day passes but that in thousands of hospitals the world over Ehrlich's technic is employed in the examination of the blood. Thus the apparently aimless fooling in Waldeyer's dissecting room in Strasbourg has become a main factor in the daily practice of medicine.

I shall give one example from industry, one selected at random; for there are scores besides. Professor Berl, of the Carnegie Institute of Technology (Pittsburgh) writes as follows:

The founder of the modern rayon industry was the French Count Chardonnet. It is known that he used a solution of nitro cotton in

ether-alcohol, and that he pressed this viscous solution through capillaries into water which served to coagulate the cellulose nitrate filament. After the coagulation, this filament entered the air and was wound up on bobbins. One day Chardonnet inspected his French factory at Besançon. By an accident the water which should coagulate the cellulose nitrate filament was stopped. The workmen found that the spinning operation went much better without water than with water. This was the birthday of the very important process of dry spinning, which is actually carried out on the greatest scale.

### III

I am not for a moment suggesting that everything that goes on in laboratories will ultimately turn to some unexpected practical use or that an ultimate practical use is its actual justification. Much more am I pleading for the abolition of the word "use," and for the freeing of the human spirit. To be sure, we shall thus free some harmless cranks. To be sure, we shall thus waste some precious dollars. But what is infinitely more important is that we shall be striking the shackles off the human mind and setting it free for the adventures which in our own day have, on the one hand, taken Hale and Rutherford and Einstein and their peers millions upon millions of miles into the uttermost realms of space and, on the other, loosed the boundless energy imprisoned in the atom. What Rutherford and others like Bohr and Millikan have done out of sheer curiosity in the effort to understand the construction of the atom has released forces which may transform human life; but this ultimate and unforeseen and unpredictable practical result is not offered as a justification for Rutherford or Einstein or Millikan or Bohr or any of their peers. Let them alone. No educational administrator can possibly direct the channels in which these or other men shall work. The waste, I admit again, looks prodigious. It is not really so. All the waste that could be summed up in developing the science of bacteriology is as nothing compared to the advantages which have accrued from the discoveries

of Pasteur, Koch, Ehrlich, Theobald Smith, and scores of others—advantages that could never have accrued if the idea of possible use had permeated their minds. These great artists—for such are scientists and bacteriologists—disseminated the spirit which prevailed in laboratories in which they were simply following the line of their own natural curiosity.

I am not criticising institutions like schools of engineering or law in which the usefulness motive necessarily predominates. Not infrequently the tables are turned, and practical difficulties encountered in industry or in laboratories stimulate theoretical inquiries which may or may not solve the problems by which they were suggested, but may also open up new vistas, useless at the moment, but pregnant with future achievements, practical and theoretical.

With the rapid accumulation of "useless" or theoretic knowledge a situation has been created in which it has become increasingly possible to attack practical problems in a scientific spirit. Not only inventors, but "pure" scientists have indulged in this sport. I have mentioned Marconi, an inventor, who, while a benefactor to the human race, as a matter of fact merely "picked other men's brains." Edison belongs to the same category. Pasteur was different. He was a great scientist; but he was not averse to attacking practical problems—such as the condition of French grapevines or the problems of beer-brewing—and not only solving the immediate difficulty, but also wresting from the practical problem some far-reaching theoretic conclusion, "useless" at the moment, but likely in some unforeseen manner to be "useful" later. Ehrlich, fundamentally speculative in his curiosity, turned fiercely upon the problem of syphilis and doggedly pursued it until a solution of immediate practical use—the discovery of salvarsan—was found. The discoveries of insulin by Banting for use in diabetes and of liver extract by Minot and Whipple for use in pernicious anemia belong in the

same category: both were made by thoroughly scientific men, who realized that much "useless" knowledge had been piled up by men unconcerned with its practical bearings, but that the time was now ripe to raise practical questions in a scientific manner.

Thus it becomes obvious that one must be wary in attributing scientific discovery wholly to any one person. Almost every discovery has a long and precarious history. Someone finds a bit here, another a bit there. A third step succeeds later and thus onward till a genius pieces the bits together and makes the decisive contribution. Science, like the Mississippi, begins in a tiny rivulet in the distant forest. Gradually other streams swell its volume. And the roaring river that bursts the dikes is formed from countless sources.

I cannot deal with this aspect exhaustively, but I may in passing say this: over a period of one or two hundred years the contributions of professional schools to their respective activities will probably be found to lie, not so much in the training of men who may to-morrow become practical engineers or practical lawyers or practical doctors, but rather in the fact that even in the pursuit of strictly practical aims an enormous amount of apparently useless activity goes on. Out of this useless activity there come discoveries which may well prove of infinitely more importance to the human mind and to the human spirit than the accomplishment of the useful ends for which the schools were founded.

The considerations upon which I have touched emphasize—if emphasis were needed—the overwhelming importance of spiritual and intellectual freedom. I have spoken of experimental science; I have spoken of mathematics; but what I say is equally true of music and art and of every other expression of the untrammelled human spirit. The mere fact that they bring satisfaction to an individual soul bent upon its own purification and elevation is all the justification that they need. And in justifying these without

any reference whatsoever, implied or actual, to usefulness we justify colleges, universities, and institutes of research. An institution which sets free successive generations of human souls is amply justified whether or not this graduate or that makes a so-called useful contribution to human knowledge. A poem, a symphony, a painting, a mathematical truth, a new scientific fact, all bear in themselves all the justification that universities, colleges, and institutes of research need or require.

The subject which I am discussing has at this moment a peculiar poignancy. In certain large areas—Germany and Italy especially—the effort is now being made to clamp down the freedom of the human spirit. Universities have been so reorganized that they have become tools of those who believe in a special political, economic, or racial creed. Now and then a thoughtless individual in one of the few democracies left in this world will even question the fundamental importance of absolutely untrammelled academic freedom. The real enemy of the human race is not the fearless and irresponsible thinker, be he right or wrong. The real enemy is the man who tries to mold the human spirit so that it will not dare to spread its wings, as its wings were once spread in Italy and Germany, as well as in Great Britain and the United States.

This is not a new idea. It was the idea which animated von Humboldt when, in the hour of Germany's conquest by Napoleon, he conceived and founded the University of Berlin. It is the idea which animated President Gilman in the founding of the Johns Hopkins University, after which every university in this country has sought in greater or less degree to remake itself. It is the idea to which every individual who values his immortal soul will be true whatever the personal consequences to himself. Justification of spiritual freedom goes, however, much farther than originality whether in the realm of science or humanism, for it implies tolerance

throughout the range of human dissimilarities. In the face of the history of the human race what can be more silly or ridiculous than likes or dislikes founded upon race or religion? Does humanity want symphonies and paintings and profound scientific truth, or does it want Christian symphonies, Christian paintings, Christian science, or Jewish symphonies, Jewish paintings, Jewish science, or Mohammedan or Egyptian or Japanese or Chinese or American or German or Russian or Communist or Conservative contributions to and expressions of the infinite richness of the human soul?

#### IV

Among the most striking and immediate consequences of foreign intolerance I may, I think, fairly cite the rapid development of the Institute for Advanced Study, established by Mr. Louis Bamberger and his sister, Mrs. Felix Fuld, at Princeton, New Jersey. The founding of the Institute was suggested in 1930. It was located at Princeton partly because of the founders' attachment to the State of New Jersey, but, in so far as my judgment was concerned, because Princeton had a small graduate school of high quality with which the most intimate cooperation was feasible. To Princeton University the Institute owes a debt that can never be fully appreciated. The work of the Institute with a considerable portion of its personnel began in 1933. On its faculty are eminent American scholars—Veblen, Alexander, and Morse, among the mathematicians; Meritt, Lowe, and Miss Goldman among the humanists; Stewart, Riefler, Warren, Earle, and Mitrany among the publicists and economists. And to these should be added scholars and scientists of equal caliber already assembled in Princeton University, Princeton's library, and its laboratories. But the Institute for Advanced Study is indebted to Hitler for Einstein, Weyl, and von Neumann in mathematics; for Herzfeld and Panofsky in the field of humanistic studies, and for a host

of younger men who during the past six years have come under the influence of this distinguished group and are already adding to the strength of American scholarship in every section of the land.

The Institute is, from the standpoint of organization, the simplest and least formal thing imaginable. It consists of three schools—a School of Mathematics, a School of Humanistic Studies, a School of Economics and Politics. Each school is made up of a permanent group of professors and an annually changing group of members. Each school manages its own affairs as it pleases; within each group each individual disposes of his time and energy as he pleases. The members who already have come from twenty-two foreign countries and thirty-nine institutions of higher learning in the United States are admitted, if deemed worthy, by the several groups. They enjoy precisely the same freedom as the professors. They may work with this or that professor, as they severally arrange; they may work alone, consulting from time to time anyone likely to be helpful. No routine is followed; no lines are drawn between professors, members, or visitors. Princeton students and professors and Institute members and professors mingle so freely as to be indistinguishable. Learning as such is cultivated. The results to the individual and to society are left to take care of themselves. No faculty meetings are held; no committees exist. Thus men with ideas enjoy conditions favorable to reflection and to conference. A mathematician may cultivate mathematics without distraction; so may a humanist in his field, an economist or a student of politics in his. Administration has been minimized in extent and importance. Men without ideas, without power of concentration on ideas, would not be at home in the Institute.

I can perhaps make this point clearer by citing briefly a few illustrations. A stipend was awarded to enable a Harvard professor to come to Princeton: he wrote asking,

“What are my duties?”

I replied: “You have no duties—only opportunities.”

An able young mathematician, having spent a year at Princeton, came to bid me good-by. As he was about to leave, he remarked:

“Perhaps you would like to know what this year has meant to me.”

“Yes,” I answered.

“Mathematics,” he rejoined, “is developing rapidly; the current literature is extensive. It is now over ten years since I took my Ph.D. degree. For a while I could keep up with my subject; but latterly that has become increasingly difficult and uncertain. Now, after a year here, the blinds are raised; the room is light; the windows are open. I have in my head two papers that I shall shortly write.”

“How long will this last?” I asked.

“Five years, perhaps ten.”

“Then what?”

“I shall come back.”

A third example is of recent occurrence. A professor in a large Western university arrived in Princeton at the end of last December. He had in mind to resume some work with Professor Morey (at Princeton University). But Morey suggested that he might find it worth while to see Panofsky and Swarzenski (at the Institute). Now he is busy with all three.

“I shall stay,” he added, “until next October.”

“You will find it hot in midsummer,” I said.

“I shall be too busy and too happy to notice it.”

Thus freedom brings not stagnation, but rather the danger of overwork. The wife of an English member recently asked:

“Does everyone work until two o’clock in the morning?”

The Institute has had thus far no building. At this moment the mathematicians are guests of the Princeton mathematicians in Fine Hall; some of the humanists are guests of the Princeton humanists in McCormick Hall; others

work in rooms scattered through the town. The economists now occupy a suite at The Princeton Inn. My own quarters are located in an office building on Nassau Street, where I work among shopkeepers, dentists, lawyers, chiropractors, and groups of Princeton scholars conducting a local government survey and a study of population. Bricks and mortar are thus quite inessential, as President Gilman proved in Baltimore sixty-odd years ago. Nevertheless, we miss informal contact with one another and are about to remedy this defect by the erection of a building provided by the founders, to be called Fuld Hall. But formality shall go no farther. The Institute must remain small; and it will hold fast to the conviction that The Institute Group desires leisure, security, freedom from organization and routine, and, finally, informal contacts with the scholars of Princeton University and others

who from time to time can be lured to Princeton from distant places. Among these Niels Bohr has come from Copenhagen, von Laue from Berlin, Levi Civita from Rome, André Weil from Strasbourg, Dirac and G. H. Hardy from Cambridge, Pauli from Zurich, Lemaitre from Louvain, Wade-Gery from Oxford, and Americans from Harvard, Yale, Columbia, Cornell, Johns Hopkins, Chicago, California, and other centers of light and learning.

We make ourselves no promises, but we cherish the hope that the unobstructed pursuit of useless knowledge will prove to have consequences in the future as in the past. Not for a moment, however, do we defend the Institute on that ground. It exists as a paradise for scholars who, like poets and musicians, have won the right to do as they please and who accomplish most when enabled to do so.





