Technological robot benevolently embracing Man at the entrance to the Hall of Science at the 1933 Chicago Century of Progress Exposition in the depths of the depression.

Physics in the Great Depression

Hard times raised hard questions that were not answered in the 1930's and remain on the agenda now.

Charles Weiner

In the spirit of the soul-searching seventies, physicists are now uneasily questioning the pace of physics and its proper place in society. They view with foreboding the changes in slope of the funding and employment curves that, along with assessments of changes in public attitudes, are the major social indicators of the health of the physics community. The immediate impact and long-range threat of reduced research funds, slackening employment opportunities and lower public esteem for physics are the apparent causes for concern. Threatened or imminent hard times are especially difficult to take on the heels of the high expectations that good times engender. This public statement by a distinguished physicist aptly characterizes the situation:

> "Let us begin by facing the facts. Physics has enjoyed a place in the sun which it can not expect to hold permanently . . . Physicists would be more than human if they were not somewhat spoiled by the popularity they have enjoyed." [1]

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The need for analysis and planning was brought to the attention of the physics community by another leading physicist in his presidential address to The American Physical Society.

> ". . . this question of organized propaganda for physics and a thorough investigation of the sociological aspects of physics are the most important problems confronting our society. Physics in this country has simply grown like Topsy, and, unless some thought is given to these matters, we may have an autopsy on our hands." [2]

These assessments of the state of US physics, which certainly appear to fit today's scene, were made in the 1930's. The growth referred to took place in the 1920's, and the problems are those of the depression. It should prove informative to look back into that decade to see what gave rise to these statements and how the physics community responded to them. Glimpses of an earlier period can provide some perspective by showing the patterns of events and by identifying some of the issues and responses of the time. There is also value in questioning the assumptions so often made about the pre-World War II development of US physics. These assumptions tend to minimize the achievements of that era as well as oversimplify its problems.

Coming of age in the twenties

The rapid growth of physics in the US, referred to by Paul Foote in his 1933 presidential address to APS, had occurred in the late 1920's, when physicists who were determined to build better departments at universities throughout the US received substantial financial support from private foundations. The major source of support was the Rockefeller-supported General Education Board, which between 1925 and 1932 provided 19-million dollars to help develop science departments in key US universities. At the same time that these efforts were being made, attention was being given to increasing the communication among US physics centers as well as between them and European centers. One of the most successful innovations was the establishment in 1919 of the National Research Fellowships, which enabled outstanding new US PhD's to pursue postdoctoral work at universities throughout the nation.

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These fellowships were awarded by the National Research Council with Rockefeller Foundation funds.

Many physicists, as is often noted, went abroad to visit and to participate in seminars and research at the major European physics centers during the late 1920's, when the analytical force of quantum mechanics was being tried on a wide variety of physical problems. Now forgotten is that, at the same time, Europeans found the research facilities at US universities increasingly desirable. For example, of the elite group of 135 European physicists who, from 1924 to 1930, received international postdoctoral fellowships from the Rockefeller Foundation, one third chose to study at US institutions; more of them were attracted to the US than to any other country. In addition, some of the most distinguished European physicists accepted invitations to lecture at US universities in the late 1920's and early 1930's.

The annual University of Michigan summer school for theoretical physics was one of the special attractions for Europeans and Americans. Begun in 1927 by department chairman Harrison Randall, the school was famous for an informal atmosphere that encouraged lively discussion. The summer school staff consisted of Michigan faculty and invited lecturers, drawn from the ranks of the best physicists in Europe and the US. The high level of the staff can be seen in this excerpt from a letter written 15 July 1930 to Gilbert N. Lewis by young Joseph Mayer, a participant in the 1930 summer school:

"[Paul] Ehrenfest, of course, rules the whole symposium like a somewhat childish Tsar, but it is a wonderful relief to hear quantum mechanics discussed with someone present who will not permit empty mathematical symbols and words to pose as explanations. For the first time since I left Berkeley I've again experienced some of the clarity and liveliness of the Monday evening colloquiums.

"[Enrico] Fermi is giving a course on [P. A. M.] Dirac's dispersion theory, Ehrenfest an unnamed course that so far has been the history of physics in the nineteenth century, and in addition there are two evening colloquiums in theoretical physics and one in experimental every week. [Philip] Morse is giving an introduction to quantum theory that I have not attended but that is said to be good.

"Fermi, by the way, is a very young and pleasant little Italian, with unending good humour, and a brilliant and clear method of presenting what he has to present in terrible English." [3]

Another innovation that demonstrates the growth of the US physics community was the establishment in 1928 of *Reviews of Modern Physics*. John Tate, editor of *The Physical Review*, asked 45 leading US physicists whether they thought a review journal was needed in the US. Edward Condon, who had returned from his postdoctoral tour of Europe a year earlier, was one of the many who gave strong support to the idea. In a letter to Tate, dated 2 October 1928, Condon said:

"I have been thinking ever since I returned from Germany that the greatest handicap to physical research work here is the lack of an adequate literature in English . . . There is no question that our laboratories are better now than those abroad, but we lack the literature which brings the young men quickly into step with the research work in the various fields." [4]

The conscious effort to strengthen physics departments and to improve communication through personal interaction and professional journals produced a unique and vigorous physics enterprise in the US. US institutions were thus in close touch with contemporary work and were often in the forefront of many fields, as in the newly developing field of nuclear physics.

This new vigor was clearly in evidence during the 1933 APS meetings, which were held in Chicago to coincide with the Century of Progress Exposition. John Slater, who was then chair-

At the University of Michigan summer school in 1930. The informal group discussion includes Maria Mayer and Joseph Mayer, on the left, Lars Onsager on the right, and Paul Ehrenfest next to him. At the rear is Robert d' E. Atkinson. The lecturer in the other photograph is Enrico Fermi.

man of the Massachusetts Institute of Technology physics department, recalls that what impressed him most was "not so much the excellence of the invited speakers, as the fact that the younger American workers on the program gave talks of such high quality on research of such importance that, for the first time, the European physicists present were here to learn as much as to instruct." [5]

Impact of the depression

Physics in the US had grown rapidly during the 1920's and the physicists' expectations were high. Then the depression hit; its effects on the campuses were felt gradually and had greatest impact in the academic year beginning in the fall of 1933. Younger men were hurt most. In some departments junior faculty were dropped, but the main brunt was borne by the new PhD's who found it extremely difficult to get jobs. Many subsisted on one small fellowship after the other; others were able to find assistantships that normally were given to graduate students; still others left physics. Faculty at the associate and professorial level were least affected, but they did receive salary cuts or "negative bonuses." These cuts were slightly offset by the decrease in the cost of living, but they still hurt. A comment from a letter written by Linus Pauling to Samuel Goudsmit in May 1933 characterizes the situation:

> "I haven't the faintest idea as to where [your former student] can get a job. Caltech is filled with our own PhD's and former National Research Fellows hoping for a small stipend. It is a shame these able men should be without positions. We have had only a 10% [salary] cut, a year ago, but may well have another. I am hoping that conditions will improve soon."

Or, to put it in the terms used by Foote in December 1933:

> "One does not require familiarity with the matrix mechanics to understand the principle of uncertainty as regards a physicist's employment during the past three years." [6]

Financial support for science was being severely reduced, and the outlook

NOVEMBER 11, 1931

ATOM NUCLEUS SEEN YIELDING TO SCIENCE

Dr. A. H. Compton Visions New Era in Physics When It Will at Last Be Smashed.

BIG GENERATOR HINTS WAY

1,500,000 Volts Leap From $90 Device in Test Before the American Institute.

The atomic nucleus, the storehouse of the vast energy of the atom, until now practically impenetrable by agencies controllable by science, has at last begun to yield to experiments which bid fair to disclose their inmost nature, it was said last night by Dr. Arthur H. Compton of the University of Chicago, Nobel Prize winner in physics, at a dinner given to scientists and newspaper men by the newly formed American Institute of Physics at the New York Athletic Club.

Experiments described by Dr. Compton as "remarkable," and achieving

SEPTEMBER 12, 1933

Lord Rutherford

Atom-Powered World Absurd, Scientists Told

Lord Rutherford Scoffs at Theory of Harnessing Energy in Laboratories

By The Associated Press

LEICESTER, England, Sept. 11.—Lord Rutherford, at whose Cambridge laboratories atoms have been bombarded and split into fragments, told an audience of scientists today that the idea of releasing tremendous power from within the atom was absurd.

He addressed the British Association for the Advancement of Science in the same hall where the late Lord Kelvin asserted twenty-six years ago that the atom was indestructible.

Describing the shattering of atoms by use of 5,000,000 volts of electricity, Lord Rutherford discounted hopes advanced by some scientists that profitable power could be thus extracted.

"The energy produced by the breaking down of the atom is a very poor kind of thing," he said. "Any one who expects a source of power from the transformation of these atoms is talking moonshine. . . . We hope in the next few years to get some idea of what these atoms are, how they are

MARCH 30, 1934

USE OF THE ENERGY IN ATOM HELD NEAR

Dr. Compton Says New Experiments Show Its Practical Use May Be Possible.

CITES SUCCESSFUL TEST

Found Expenditure of 100,000 Volts on Atomic Bombardment Produced 3,000,000 Volts.

Science has obtained conclusive proof from recent experiments that the innermost citadel of matter, the nucleus of the atom, can be smashed, yielding tremendous amounts of energy and probably vast new stores of gold, radium and other valuable minerals, Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, declared last night before a meeting of the Institute of Arts and Sciences of Columbia University at McMillin Academic Theatre, Broadway at 116th Street.

Although much energy must still be used to bombard matter in order to release atomic energy, the efficiency of the process is increasing and there are hopeful signs that was dim. A survey of the congressional appropriations bill by Science Service, published in July 1932, showed that funds for scientific research in the various government departments had been cut 12.5% for the 1932–33 fiscal year. Further cuts were made by President Herbert Hoover in the budget estimates he submitted to Congress in December 1932.[7] Operating funds of the National Bureau of Standards, the major government employer of physicists, were effectively cut 70% between 1932 and 1934.[8]

The impact of budget cuts at the universities can be seen in these telling excerpts from F. Wheeler Loomis's annual reports for the University of Illinois physics department, which, under his leadership, had been among the departments making rapid strides in the preceding years:

> 1931–1932 "The outstanding feature of this year in the physics department, as probably in all others, has been the curtailment of our activities made necessary by the financial emergency in the University. Since the time the economy orders were promulgated in January the department will have saved out of its appropriations about $3500, or 40 percent of the maintenance and operation budget for the year . . . most severely affected will be, of course, the research."
>
> 1933–1934 "The salient features of the past year in the physics department, have been the effects of the depression budget and the reduced enrollments in the courses. The department has had to get along with half the operating funds it had in the past and with no money at all for new equipment."
>
> 1934–1935 "The department, whose operating expenses have been reduced to a starvation point for over three years, suffered a financial crisis this winter and pretty nearly had to close up . . . It is almost impossible to convey an adequate idea of the extent to which our work, both in teaching and research, has been hampered and made inefficient and how all progress has been blocked by the inability to buy necessary articles. We should have had pretty nearly to cease activity in research if it hadn't been for the equipment which was bought in our three boom years 1929–32. . . ."[9]

The unfilled aspirations of budding physicists and the despair of department chairmen were amplified in public statements by spokesmen for the scientific community including William W. Campbell, astronomer and president of the National Academy of Sciences and Karl T. Compton, chairman of the board of the newly formed American Institute of Physics. In 1934 Campbell stressed that cutbacks in financial support of science had interrupted the careers of students and researchers and that many of them would be lost to science. The quality of research was still good, but, he warned, if the reduced scale of support continued for two or three more years, the results would be very bad indeed.[10] Compton and Henry Barton, director of AIP, called for an increase in government support of research to offset the decline in private support. But, if scientific research was to be supported by public funds, then the public had to be informed and convinced of the benefits of research. Determined efforts to do this were made by AIP.

Public image of physics

The public was not unaware of new discoveries in physics, especially in nuclear physics, which promised to yield new sources of energy. Newspapers and magazines described the exciting results of the "atom splitters," including artificial disintegration of the light elements and discovery of the neutron. Despite Ernest Rutherford's public ref-

JUNE 4, 1931.

PHYSICS INSTITUTE WILL BE ORGANIZED

Dr. K. T. Compton, Head of M. I. T., Announces Plan to Knit All Branches in Field.

SOCIETY WILL SERVE PUBLIC

Press Department to Explain New Laboratory Discoveries as They Occur.

CAMBRIDGE, Mass., June 3 (AP).—Plans for formation of a consolidated scientific organization to be known as the American Institute of Physics were made public today by Dr. Karl T. Compton, president of Massachusetts Institute of Technology.

Both science and the public are to be served. The institute will bring together several scientific organizations now separate but having common interests. It will also knit together a great group of men in industrial laboratories and manufacturing plants who, as physicists, play a most fundamental rôle in modern industry, but who have not heretofore constituted a well recognized unit. Also in schools and colleges, local or student branches of the institute may be founded.

For the public there will be a press department to explain some of the fascinating laboratory happenings which often remain masked behind unfamiliar scientific words. This will include coöperation with the press and contacts with local groups interested in physics.

The plans were started jointly by

ew York T

NEW YORK, FRIDAY, FEBRUARY 23, 1934.

Leaders Deny Science Cuts Jobs; Warn Against 'Research Holiday'

Dr. Millikan Declares Technological Unemployment Is a Myth—Compton Proposes Federal Subsidies for Invention—Roosevelt Aids All-Day Symposium Here.

Science struck back at its critics yesterday, and with the aid of some of its inventions—the radio, sound cameras and loud-speakers—it told the world that science makes jobs and does not end them.

Fortified with statistics to confound the technocrats, armed with a message from the President, and bearing determined and bulky statements, science—under the auspices of the American Institute of Physics and the New York Electrical Society—made a Roman holiday.

Two of its leading representatives, Dr. Karl T. Compton, president of the Massachusetts Insti- tries" in the near future and make many jobs.

The electron, he pointed out, had "gotten into industry" and had "created jobs" in enormous numbers, and research in pure and applied science undoubtedly would produce other brain children that, when harnessed, would make industries and provide jobs for thousands.

Dr. Compton, in explaining the purpose of the day-long symposium on "Science Makes Jobs," said scientists were "trying to combat the prevalent idea that science is responsible for the present difficul-

NOVEMBER 28, 1935.

DR. CONANT OPPOSES CURB ON RESEARCH

'Planning' of Science Would Check Intellectual Activity, Harvard President Says.

PRAISES CARNEGIE METHOD

Free Hand for Exceptional Men Urged—Dr. Keppel Sees Big Trusts Facing Changes.

Dr. James B. Conant, president of Harvard University, took issue last night with the theory that brakes should be put upon the increase of scientific research and knowledge. He spoke at a dinner in the Waldorf-Astoria Hotel, ending the centenary celebration of Andrew Carnegie's birthday.

The dinner was given by the Carnegie Corporation of New York, which has had charge of the centennial celebration in the United States and the British dominions. It was attended by members of the Carnegie family and by many who knew Mr. Carnegie or worked with him in the establishment of his philanthropic trust funds.

Dr. Conant predicted that the next twenty-five years in American utation of the idea that tremendous amounts of energy could be released from the atom and harnessed, many scientists, science writers and laymen eagerly discussed the possibilities. Rutherford's statement has been frequently quoted in recent years:

"The energy produced by the atom is a very poor kind of thing. Anyone who expects a source of power from the transformation of these atoms is talking moonshine. . . ." [11]

Less well known now are the more optimistic views of other physicists. Attached to the *New York Herald Tribune* account of Rutherford's talk was another news item quoting Ernest Lawrence on the need to develop an efficient method of obtaining atomic power. Lawrence concluded: "I have no opinion as to whether it can ever be done, but we're going to keep on trying to do it." [12]

Despite the disagreement among scientists, public interest in atomic energy was high in the early 1930's. But although the public often associated the physicist with expectations of practical applications of atomic energy, it also increasingly linked him with unfamiliar complexities. Mingled with headlines such as "Use of the Energy in Atom Held Near," were such editorial comments as:

"It is not the electron that needs seven dimensions but the mathematicians. The world awaits another Newton to reveal simplicity. We are merely in the stage of experimenting with theories. Out of it clarity must issue if science is not to become irrational."[13]

In 1934, commenting on the complexity of the neutrino concept, the *Times* asked: "Can it be that nature needs eight particles in constructing the cosmos? Or is it the physicists who need them." [14]

Antiscience movement

More significant than the ambivalent public image of physics in the early 1930's was the changing public attitude towards science in general. As the depression wore on there was an increasing disenchantment with the "technological progress" that had long been associated with science. Science-based technology and the labor-saving devices it had produced were variously seen as uncontrolled, unplanned or misappropriated and, in all cases, as a major factor in the deepening economic crisis and the resulting despair. One proposed solution was to declare a moratorium on scientific research. The "Stop Science" movement dated back to the late 1920's in England and found increased social resonance in the US in the early 1930's. It is difficult to determine how widespread this attitude was, because it was only occasionally articulated. It was, however, perceived as a major threat by leaders of the scientific community, because it occurred at precisely the time when scientists needed to make an effective case for increased public support.

Even before the economic crisis, criticism of science was gaining ground among those who saw it as a threat to humanistic values. Late in 1928, Robert A. Millikan commented on "the current opposition to the advance of science," and told his Chamber of Commerce audience that the *real* question was "how the forward march of pure science, and of applied science which necessarily follows upon its heels, can best be maintained and stimulated." [15]

By mid-1932, the realities of the depression sharpened the criticism of science and modified the response. In a speech dedicating the Hall of Science for the Chicago Century of Progress Exposition, Frank B. Jewett, head of the Bell Telephone Laboratories noted:

"In some quarters a senseless fear of science seems to have taken hold. We hear the cry that there should be a holiday in scientific research and in the new applications of science, or that there should be a forced stoppage in the extension of old usages by mandatory legislation." [16]

Jewett's response was a call for greater efforts to weave science into the social structure. The purpose of the Century of Progress Exposition, he said, was to increase understanding of the real place of science in the social structure and of those factors that have their roots in science and must influence the course of social controls in the years ahead.

Science was the theme of the exposition. Chicago was celebrating her centenary as a city, and the planners of the exposition wanted to show that the city's growth had been united with the growth of science and industry during the preceding century. The National Research Council enlisted the support of 400 scientists and businessmen to advise on exhibits. During the three years preceding the opening of the exposition, about 90 physics exhibits were devised and assembled by a group of physicists under the direction of Henry Crew. Similar exhibits represented the other sciences.

The exposition itself was opened in a dazzling manner to emphasize the accomplishments of science. Light that had ostensibly started its journey to earth from the star Arcturus 40 years earlier (at the time of the last great Chicago exposition) was relayed to Chicago from the 40-inch refracting telescope at Yerkes Observatory, Wisconsin, in the form of an electrical impulse to start the big show's night life. (The distance to Arcturus is now known to be about 36 light years.) The guidebook put it this way:

"A miracle, they would have said a hundred or even forty years ago. But today, the 'electric eye,' relays, vacuum tubes, amplifiers, microphones, which respond to the tiniest fluxes of energy, help to do the work of the world in almost routine manner. Progress!" [17]

The exuberant celebration of science and its applications took place in one of the worst depression years, and a major aim was to demonstrate that "the steady march of progress" could not be stopped by temporary "recessions." Considering the large number of unemployed in 1933, one wonders how the fair-going public reacted to the slogan boldly proclaimed in the official guidebook: *Science Finds—Industry Applies—Man Conforms!* [18] The use of science at the exposition may have been imaginative and entertaining, but it provided no real answer to critics who called for a research holiday. Instead it provided a dramatic reaffirmation of the relation of science to a technology that, in the eyes of some critics, had been misdirected and thus had contributed to existing social evils.

Response of the physicists

By late 1933 leaders of the physics community were alarmed about the criticism of science, because such criticism threatened to reduce public support of research even further. Their approach was to deny that science had caused unemployment. On the contrary, they asserted, science had created more jobs, and greater support of science could help to end the depression. Barton was among those who called for more flexible political and economic institutions and for methods to cope with "natural and unavoidable increases in human knowledge," [19] but the major emphasis of the scientists' response was simply that the answer was more rather than less science.

AIP and the New York Electrical Society (an engineer's group) responded to the crisis by conducting a well publicized symposium, "Science Makes More Jobs," in February 1934. Speakers included Karl T. Compton (who was president of MIT as well as chairman of the AIP Board of Governors), Millikan (president of the California Institute of Technology), Frank Jewett and William Coolidge (director of the General Electric Research Laboratory). Their talks, urging continued support of scientific research by government, universities and industry, were broadcast nationwide. Letters were read from President Franklin D. Roosevelt and from Albert Einstein, who pointed out:

". . . one cannot be sufficiently cautioned against the attempt to economize on scientific work. On the one hand, the progress of important branches of technology depends

Visitors in the Hall of Science at the 1933 Century of Progress Exposition. This photograph and the one on page 31 are used by permission of the Library, University of Illinois, Chicago Circle Campus.

on the results of experimental and even of theoretical science; and on the other, each disruption of scientific work causes lasting damage to the living body of research; that is to say, a partial forfeiture of previously expended labor and capital. . . . Hence, it is in the interest of this country to put on a secure footing the continuation of scientific investigations on the previous scale . . . ."[20]

The symposium was not unnoticed. A front page article in *The New York Times* the next day began "Science struck back at its critics yesterday . . .," and a full account of the meeting and the major points of the speeches followed. The editorial page, however, expressed disappointment:

> "Neither the statistics nor the argument are new. Nor did any of the protagonists of the laboratory explain why there is poverty amid plenty, and idleness where we expect to hear the hum of the machine. We look to them for a way out of the slough, only to find them as helpless as the economists. As yet no one has devised the means of absorbing new technical developments with the least possible amount of distress. The question of pace is all important."[21]

The editorial went on to call for a government plan to apply science without neglecting "human aspirations" and "moral values."

The scientists simply had not addressed themselves to the immediately relevant questions of the social management of science and its applications. They had *assumed* that science and technology were the sources of progress that would lead to desirable improvements in the social condition. Although the tone was more defensive than the slogans of the Century of Progress Exposition, the message was the same. No wonder then, that even some friends of science tended to discount the scientists' statements as special pleading.

While science was attempting to answer its critics, efforts were also underway in Washington to improve coordination of government scientific work and to develop an emergency scientific program to combat the depression. Karl Compton was chairman of the Science Advisory Board appointed by President Roosevelt in 1933. Compton emphasized the need for major government support of applied science; some of the money could then be used to support basic science. His theme was expressed in the title of an article he wrote in 1935: "Put Science to Work: The Public Welfare Demands a National Scientific Program."[22] To bolster his point that science should have greater, rather than less, government support, he argued that other nations had more enlightened policies toward the support and organization of research. But the Board's activities were often marked by disagreements about the relative roles of the social and natural sciences. Another major roadblock was the fear of many scientists that government support would lead to government control and to the involvement of science in political and social issues. The Board went out of existence in 1935, and all concerned agreed that it had been a failure.[23]

In general, the arguments used during the early 1930's to encourage greater moral and financial support of science by the public went wide of the mark. It was not enough merely to reassert that the basic science–applied science–technology cycle would alleviate the economic and social crisis. In answering their critics, scientists did not respond adequately to the public's fear that uncontrolled and misapplied technology caused human misery. Karl Compton and others did urge individual scientists to analyze social, economic and political problems, and to ask at what points science could be usefully brought to bear on them.[24] But spokesmen for the US science community appeared reluctant to deal publicly with the social and political issues involved in revamping institutions and in discussing the rate and direction of the application of science. Justifying public support of science as a social good, however, implicitly involved assumptions about the social processes leading to eventual application of research. To ignore the growing concern with the need to analyze and improve these social processes was to weaken the argument for support of science.

The problem disappears

Things got better anyway. After 1935 the financial pinch eased and more academic teaching jobs became available; young physicists were needed to cope with the increasing enrollments in US colleges and universities. The improvement was only gradual, however, and in the middle and late 1930's the search for employment took many

physicists into work they had not previously considered (for example, into oil fields as part of industrial geophysical research teams). A major effort was made by AIP during this period to call attention to the role of physics in industry, and symposia were held throughout the country to explore how this role could be increased for the benefit of industry, the nation and the physicists. These efforts raised occasional questions about whether the new physics PhD's were properly prepared and motivated for industrial positions, but apparently no major change in physics education resulted.[25]

By the end of the 1930's, growth curves looked good again. More than 1400 physics doctorates were awarded by US universities from 1931 to 1940, double the number awarded in the preceding decade.[26] The physics profession in the US had also been enriched by about 100 very talented physicists who had emigrated from Europe because they were unable or unwilling to continue their careers in Nazi-dominated countries.[27] By the spring of 1941 an estimated 4600 physicists were at work in the US, about half of them with doctorates,[28] and total expenditures for scientific research in the US had doubled during the decade.[29] Despite the depression crisis, physics had recovered and normal "progress" had returned.

During the dismal depression days questions about the internal dynamics of the physics community and about its relationship with the larger society were raised. These questions remained unanswered, to emerge again in other times of crisis. Although the vast changes that have occurred since the 1930's in physics, in the physics community and in the role of physicists in society have been accompanied by new questions and problems, the continuity of certain issues is clear. The perspective provided by the experiences of the depression emphasizes the pressing need and new opportunity to make (borrowing Foote's 1933 phrase) "a thorough investigation of the sociological aspects of physics." In the 1930's adequate answers were not provided to the challenges to the social relevance and human implications of physics, because general improvements in the economic and political situation permitted resumption of the growth of physics. But physicists now have another chance to respond, and they must if they are to cope with the present crisis and plan for the future.

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