THE VOICE OF SCIENCE ON CAPITOL HILL

F.A.S. *PUBLIC INTEREST REPORT*

Formerly the FAS Newsletter

THIS ISSUE:
HEALTH OF SCIENCE
ATTRACTING THE BEST

Vol. 30, No. 1 January, 1977

HEALTH OF SCIENCE: ATTRACTING THE BEST OF THE YOUNG

There is no single way to measure the health of science. But there are isolatable phenomena which would clearly be unhealthy. It is hard to think of one which is more obvious than to cease to enlist the very best of the young, even for as short a period as a decade or two.

Yet this seems to be threatening in the phenomenon of the "tenure block." In the hundred years since 1870, there has been rapid (and ultimately unsustainable) growth in higher education. 1960-1970 even saw a rapid acceleration of growth to service the post-war baby generation. But now enrollment is falling, and with it academic needs for faculty, which needs have always been a mainstay of Ph.D. absorption.

A serious employment problem facing new doctorate recipients is therefore evident in the eighties when doctorate production — geared to the unusual growth rates of the mid-1960's — will peak while academic employment is projected to be at its lowest level. Students, often more aware of impending problems than even their faculty, are aware of the oncoming crunch.

Not only the average Ph.D. but also the most productive Ph.D.'s face problems. This is because of the tenure tradition which, after an initial period of about six years of temporary employment, calls for hiring faculty permanently or letting them go. The recent history of rapid growth has left most universities with a largely permanent faculty of persons usually quite far from retirement. Thus the excellent new scientist who wants a tenured position at a first-class university will find, in the next decade or two, an extraordinary paucity of openings.

The importance in science of encouraging at least the very best will be obvious to most readers. It is estimated that as few as 20% of the scientists who publish produce more than half of all published works and these the most often cited and the most important.

It is proverbial that new approaches often require new minds. It is traditional that the best discoveries are often made by young scientists. And it is a statistical fact that many lose their productivity quickly with years. One could therefore lose a good part of a decade of progress if the young were even temporarily shut out.

With all this in mind, it seems important for the government to provide some light at the end of the tunnel for the most talented of the scientifically inclined young — some hope of surviving the bleak eighties. After that period growing retirement will lead, in time, to a surplus of new tenured positions as the demographic bulge of tenured professors moves along to retirement.

That the problems cannot be solved without governmental assistance is all too obvious. The federal government is already supporting 70% of academic basic research precisely because the magnitude of expenditures involved is too great for other sources. The universities and colleges have, in turn, definitely become the place where basic research is done: they generate 75% of all U.S. scientific research reports.

What could be done? The problem seems to be one of providing holding patterns for those superb young scientists who — under steady-state conditions — would have been provided tenured positions at the

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— *Reviewed and Approved by the FAS Council*

ISSUES IN THE HEALTH OF SCIENCE

The health of science is a multidimensional affair. The editorial discusses a narrow aspect and one that is not, by any means, the aspect most central to FAS's purpose. Members are invited to describe problems in the health of science to which they would like FAS to draw attention. The Office of Technology Assessment (OTA) has underway a similar investigation and we have devoted page 6 to reprinting, at its request, a communication from that office, soliciting comments from scientists at large.

A few issues may be of special interest to members. How can socially useful work be found for the many thousands of Ph.D.'s who will be produced in coming years without available positions of the traditional kind? How can scientists in traditional positions who wish to engage in public interest activities be assisted in doing so? How often are scientists asked to engage in activities which they find socially irresponsible and how can their integrity be protected?

Arms Race to Be Treated In February Report

There appears to be a resurgence of right-wing pressures that are focusing on Soviet weapons procurement and the role of civil defense in the Soviet Union. A number of related groups are organizing to put pressure on the new Administration in its efforts to shape arms race and SALT policies and to determine whether to build the B-1 bomber, the MX missile, the cruise missile and so on. The February Report will treat some of these issues. ☐

PUBLIC SERVICE AWARDS—7; HIROSHIMA AND NAGASAKI MAYORS VISIT FAS—8

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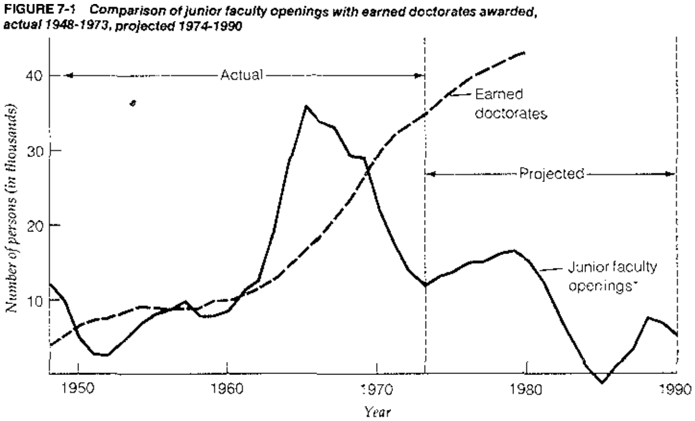
leading research universities. In due course, as the faculty tenure shortage becomes a surplus, these scientists can be offered positions from the surplus along with those still younger.

For example, if five-year (once renewable) fellowships were offered on a competitive basis, their recipients could negotiate with universities for tenured, positions (much as, in principle, they do now) in their sixth year. But the universities would not have to pay for the faculty member for four more years. And the scientists would have a four-year safety net. A program of this kind, with awards provided for each of five years or ten years, would help the universities for a period of fifteen or twenty years during which much of the tenure block would be dissipated. In short, a program of this kind would be devoted to smoothing out the demography of faculty hiring, avoiding an oscillation which is inefficient even in boom times, much less in those of hiring bust.

We do not mean by this proposal to suggest here that science needs either more or less money in general. And we do not in this proposal address the important problem of making socially productive use of the many thousands of Ph.D.'s who will find no academic jobs in the 80's. Nor do we mean to propose a research WPA. What we are talking about here is a very small number of Ph.D.'s, the most scientifically talented 100 or 200 persons in an entire cohort comprising some 2,000,000 persons. This elite 1% of the top 1% of the population is far too important a resource for America to permit to go unused.

FIGURE 7-1 *Comparison of junior faculty openings with earned doctorates awarded, actual 1948-1973, projected 1974-1990*



*Three-year moving average.

SOURCES: Earned doctorate data from Table 5-5; faculty openings for 1973–1990 from Table 6-10; earlier estimates by the author based on U.S. Office of Education reports of faculty in higher education.

Allan M. Cartter (Ph.D's and the Academic Labor Market)

THE SITUATION IN MATHEMATICS

. . . because of the great expansion of the late 1950's and 1960's most of the faculty is young. For the next 15 years, the yearly retirement rate will be only about 1% per year, increasing sharply in the mid-1990's to 5% or 6% . . . it appears likely that in a few years some or many of the very best young mathematicians will be caught several years after their degrees leaving the best places and with literally no place to go in academe. It will be devastating to the individuals and highly destructive of research morale generally.

—letter from R. D. Anderson,
Former Chairman of the American Mathematics Society Committee on Employment and Educational Policy; December 11, 1976

The Federation of American Scientists is a unique, nonprofit, civic organization, licensed to lobby in the public interest, and composed of 7,000 natural and social scientists and engineers who are concerned with problems of science and society. Democratically organized with an elected National Council of 26 members, FAS was first organized in 1946 as the Federation of Atomic Scientists and has functioned as a conscience of the scientific community for more than a quarter century.

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SCIENTIFIC EMPLOYMENT AND HEALTH OF SCIENCE

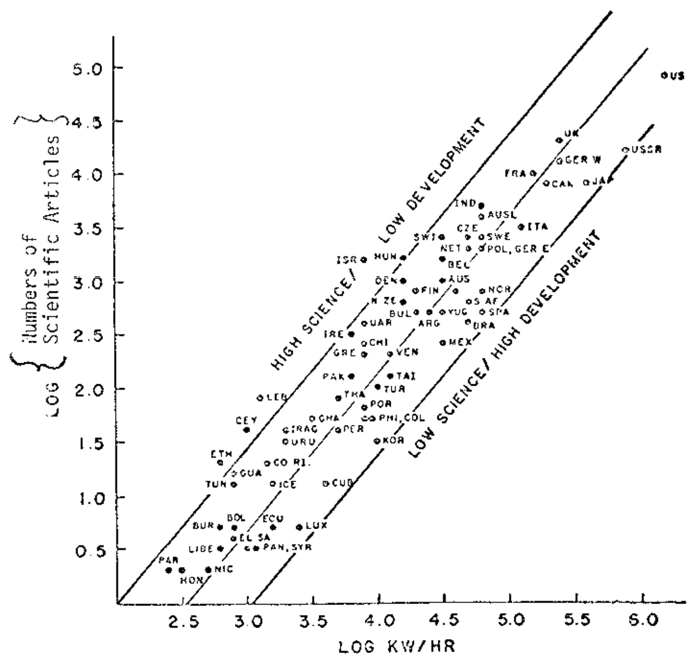
According to Derek de Solla Price, a large fraction of scientific papers are produced by a small and stable core of the publishing population.* By his calculation, the approximate situation is as follows: Of 100 scientists publishing in a given year in any field of science, 33 are newcomers to the field, and of these, 22 will not continue. The net gain of 11 people is offset by about 4 "deaths" of scientists who were at the research front but discontinue. The result is a 7% growth of scientists at the front which has, he believes, characterized the demography of scientific research for several centuries in countries of a wide variety of social and educational states and systems. In this way, the scientific community of publishing scientists has doubled every decade for many decades and, with it, the output of these scientists has also.

This pattern is long substantiated. Studies of pre-Civil War scientific journals in America show that 10% of the scientists who published were responsible for 50% of all the articles printed in the United States. In 1848-1860, 11% (31 men) were responsible for 51% of the papers presented to the AAAS. (See *The Formation of the American Scientific Community,* S. G. Kohlstedt, pg. 205). The scientific community has grown but the structure persists.

Price finds today that only 20% of those publishing are publishing in every year for a long period. But this small core group of 20% will produce more than half the total output.

Price and Gursey find that the transient publishers are normally ignored, with 70% of such papers uncited. However, the papers produced by "core continuants" in science are almost always cited. As is obvious to working scientists, the quality of the publications of the best scientists is correlated with their quantity.

In short, it is not healthy for scientific production to absorb and maintain the largest possible number of scientists, but, instead, to identify, cultivate, encourage and maintain the scientist who is destined to be productive over a period of time.



Dr. Price believes that, within surprisingly close limits, the number of scientific authors within each country of the world is given merely by the country's population and its level of economic development (GNP per capita or kilowatt-hours of electricity). Since the smaller, poorer and less developed nations are growing more rapidly than the rich countries, they will catch up in scientific output. Indeed, he sees the disparity to be of such a size as to bring the less developed world to an intensity of development in science comparable to that of the rich countries within a few decades.

(These overall estimates of Price hide the fact that, within specific scientific fields, there is significant disparity in the number of papers published and the GNP per capita index of a country. Scientific Indicators 1974 shows that the U.S. percentages of the world scientific literature are about:
Chemistry 25%;
Physics 40%;
Mathematics 25%;
Molecular Biology 45%;
Engineering 45%;
Psychology 75%;
Systematic Biology 30%.)

THE PROBLEM OF YOUNG DOCTORATE FACULTY

It is not nearly so easy as one might think to project labor market conditions in academia. College-age population is known long in advance but not the percentage that will, by going to college, provide a demand for faculty. The extent to which a financial squeeze will distort faculty-student ratios is another imponderable, dependent upon college administrators. The net inflow and outflow of faculty to industry and elsewhere may shift also. If faculty salaries fall, for example, faculty may leave, providing positions for new young faculty members.

But one thing is clear. The graduate schools until recently expanded as if educational demand would continue indefinitely and produced a capacity for Ph.D.'s that is much larger than necessary for the 1980's. It is estimated that academic demand will not require more than 20% of academic production in the 1980's. This should be compared with the fact that teaching was in 1973 the primary activity of 50% of new doctorate recipients. (It ranged from a high of 77% for mathematicians to 36% for chemists).

The projected situation can be seen in the page 2 graph. Enrollment dips slightly but projection of new faculty needed hits near zero in the middle eighties, before it begins to rise.

The best survey of the general situation seems to be provided by the late Allan M. Cartter *(Ph.D.'s and the Academic Labor Market).* He expects student-faculty ratios to rise, damping down expansion demand in the late 1970's and encouraging contraction in the 80's. This

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*There are about 200,000 scientists and engineers working at the research front, of whom about 100,000 are a continuant population and the other 100,000 are transients who will soon cease to publish. They are embedded in a population of about 525,000 R&D workers, mostly engineers, doing applied research and development. These half million are, in turn, embedded in a population of scientists and engineers about three times larger, most of whom are engaged in production, management and teaching.

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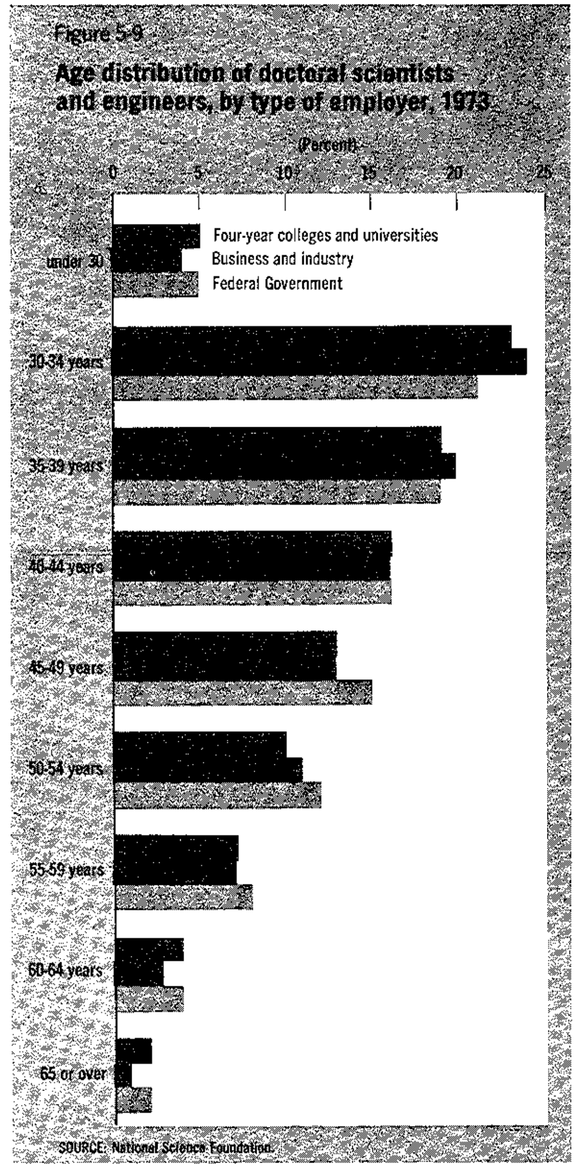
is coupled with a 25% decline in the size of the traditional college-age population. The trouble with the impending situation is its across-the-board character. A change in fashions between one field and another will not fix the situation.

If there were zero net migration of faculty in and out of academia, and if death rates before retirement were negligible, then one could imagine tenured faculty serving for about 30 years before retirement. The net effect would be a retirement rate of about 3.3% a year. (Seventy percent of the faculty of four-year colleges and universities were over 35 years old in 1973, and this was the percentage of faculty that was tenured in the doctorate-level departments. Hence a simple model could assume that, at that time, all over 35 were tenured and under 35, not).

In fact the rate is destined to be much lower for a substantial period and then much higher. The adjoining graph reveals, as of 1973, the extent to which the academic faculty is now quite young. A demographic block of younger faculty members is far from retirement but, in due course, will produce a large number of retirements. For example, calculating from this graph would suggest that the faculty distribution, as of 1978, of faculty over 35 would be about:

Age	Percent of total 1978 (over 35) faculty	Percent of Total Retiring each year for 5 years in question	Year Retiring
60-64	8%	1.6%	1979-83
55-59	11%	2.2%	1984-88
50-54	14%	2.8%	1990-94
45-49	18%	3.6%	1995-99
40-44	22%	4.4%	2000-04
35-39	26%	5.2%	2005-09

This would suggest retirement rates that run from 1.6% in the first five years to over 5% 30 to 35 years from now, increasing in stages. The 3.6% "steady-state" approximation would occur in about 1995. A five percent retirement would occur after 2005.



What to Do?

NSF is considering a scheme of this kind: Senior faculty members within perhaps six years of retirement would be given a grant (perhaps for six years) that would free them from teaching. This would be given for research promise. To receive the grant, however, the university would have to promise to take an equivalent amount of money and use it to hire a young Ph.D. The Ph.D. might receive, for example, a three-year (once renewable) fellowship. By the time the new Ph.D. had finished his fellowship, the university would have secured the retirement of the older researcher. The salary of that researcher would then be freed to support, if the university so desired, the tenure of the young Ph.D.

This method would be continued until such time as faculty began to retire in higher than steady-state percentages, at which time the university would have enough slots to sustain the NSF-supported fellows and entirely new fellows as well.

NSF does not have as complete statistics on when this might be as one would desire. It seems to believe that 4 to 4.5% of relevant faculty slots might become available as early as the 1985-1995 period and that, at present, 3% are opening up each year. (Other calculations might suggest another decade would be required before the period passes from scarcity to surplus) . But assuming this optimistic result, one might need to give such fellowships for a period of only seven years (1978-1984) before breaking into a period of surplus slots.

What would this cost? If one assumes 50 research universities, with 1,500-person faculties, one-third of which are in science and 75% tenured, this gives 18,750 tenured faculty at issue. To artificially up the rate of retirement by 1% would require giving about 187 (say 200) fellowships each year. At $25,000 each, one would spend $5,000,000 the first year. At the peak of a six-year program, it might cost $30,000,000 per year. (The NSF budget is over 700 million at present).

The Direct Approach

It is not necessary, of course, to give the grants to senior faculty with junior faculty benefiting indirectly. An FAS back-of-the-envelope calculation suggests one might provide five-year (once renewable) fellowships for a period of ten years. Starting in 1978, for example, this program could carry early fellowship holders to 1988 and late ones to 1998. If one restricted oneself to a smaller

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number of fellowships a year, e.g. 100, and provided $20,000 per year, this would cost $2,000,000 in the first year, and in the peak year, $20,000,000.

In the 1988-1998 period into which the fellowship holders would surface, the universities would begin to see a more than steady-state number of tenured positions opening. Thus they could absorb the fellows who were in orbit along with new junior faculty.

Some Sample Details

The universities might decide on tenure for the fellowship holder, much as they do now, in the sixth year. But, as noted on page 1, they would not have to pay for his services until four years later. For the early fellowship holders, the university would still not have, by the time of termination of the fellowship, a surplus of positions open. But it is feasible for the university to mortgage future tenured positions to bridge the later gap of several years.

One would want to assume that the fellowship holders did not all attend the same universities since, among other things, this would defeat the purpose of the plan — to place the young scientists in tenured positions. For this reason, NFS might assign the university a number of fellowship slots depending upon the state of its tenure demography. That having been determined, the universities might then offer the fellowships on a competitive basis so that applicants would spread themselves among universities much as do entering students.

HEALTH OF SCIENCE

"The Panel defines the Health of Science and Technology as the present and future capacity of the system to generate new knowledge and conceptual understanding of the natural and man-made world, and to match the resulting insights with potential benefits to man, with improvements in the capacity of our society to make intelligent choices about the deployment and control of technology, and with our capacity to enhance the public welfare." — Harvey Brooks to OTA panel, August 30, 1976.

"[Science Indicators, 1972] has led to the recognition by serious observers of science that there is no easy or noncontroversial way to measure the 'health' of science." — Roger Heyns, Pres., American Council on Education, May 19, 1976.

Underlying all these questions of "health" is the question: "Compared to what?" Normally, one compares U.S. science and technology to that of other nations and, typically, applies the standard of "are we still first?" But the problems here are evident. It would not be a sign of unhealth of American science if other nations began to publish more, have their articles cited more often, or win more Nobel Prizes. Indeed, it is to be expected that they will, as part of their process of economic development. In fact, if Price is right that the rate of publication is closely related to GNP per capita, then publication indices of scientific health would be as irrelevant as saying that our economic health turns on maintaining a large margin of superiority in GNP per capita over other states.

The matter is further complicated by the fact that science is a cooperative international endeavor. Our science will progress faster (be healthier?) if it has healthier partners, since in this case the community as a whole moves forward faster. If, for example, all of foreign science were suddenly to be withheld from us, it would be a blow to our scientific capacity of enormous dimensions. Indeed one sign of health in our community is its ability to process and exploit the science elsewhere.

Then there is the question of goals. To the extent that science serves a cultural goal, it would be healthier if larger numbers of persons shared its pleasures and enjoyed its triumphs, much as America would have a healthier artistic sector if more people learned to appreciate art. Little attention is normally given to this dimension. Presumably, higher educational levels and better teaching of science are strengthening this dimension of scientific health.

If one sees science as a basic pool of information from which society draws its technology for societal needs, then science would be healthy to the extent to which it was providing the necessary knowledge. Conceivably, it could even be deemed unhealthy if it was leading, through inexorable societal processes, to unhealthy technology.

If one sees science as autonomous, one can consider it healthy to the extent to which it grows. If the pool of knowledge is growing at a rapid rate, science will be healthy, but not otherwise.*

There are obviously less thoroughgoing notions of health. It is unhealthy for science to be unable to attract first-class talent or, on the other hand, to be attracting much larger numbers of persons than can do science well. It is unhealthy to be growing at a rate that cannot be sustained, or not to be growing at all. It is healthy to be providing technology that suits the public, and unhealthy not to be doing so.

A questionnaire of the National Science Board, "Science at the Bicentennial," found most university officials complaining first and foremost that there was: "pressure for applied, overly targeted, rather than basic, research." Their second most sustained complaint was a lack of continuity in funding, and of support for longer grants. Obviously, these two concerns are continual irritations. Third in their expressions of concern, and emphasized by chairmen in all departments except those of social and behavioral sciences, was the tenure problem of younger faculty.

*These categories have benefited from an analysis of Harvey Brooks, "Can Science be Planned," but one category, science as a social overhead, has been omitted.

BASIC RESEARCH HAS MOVED TO ACADEMIA AND THE GOVERNMENT FUNDS IT

From 1953 to 1974, the percentage of all basic research done in universities and colleges moved from 26% to 54%. The scientists and engineers at the universities and colleges are now responsible for 75% of the U.S. scientific research reports. The basic research at issue is done almost entirely (98%) at those universities offering doctorate degrees. Sixty percent of university R&D is spent in the biggest 40 R&D spending universities.

Upward of 70% of this research is now funded by the Federal Government. (In 1974, this percentage varied from a high of 87% in physics to 58% in the social sciences).

Three quarters of the Federal funding comes from just two Federal agencies: NSF and HEW. NSF is already the largest or next largest supplier of Federal funds in every one of the seven major fields.

OFFICE OF TECHNOLOGY ASSESSMENT INVITES COMMENTS ON HEALTH OF SCIENCE

The Congressional Office of Technology Assessment (OTA) has initiated a long-range program on R&D Policies and Priorities. Three separate advisory panels have been established, with their work to be coordinated through OTA's statutory Technology Assessment Advisory Council (TAAC), which is chaired by Jerome Wiesner of MIT. The three panels are to deal respectively with: the Health of the Scientific and Technological Enterprise; the Applications of Science and Technology including industrial research and innovation; and the Decisionmaking Processes whereby the nation sets its policies and priorities with respect to the allocation of R&D resources and the utilization of scientific inputs in government policy generally.

The Panel on the Health of the Scientific and Technological Enterprise, chaired by Harvey Brooks of Harvard University, would like suggestions from the technical community and from other interested and concerned publics. It is particularly interested in receiving views as to: what issues should be given priority in its agenda; what are some of the perceived problems and strengths of the present system of overall management and support of research and development in the United States; and how the future system might look. The purview of the Panel includes but is not restricted to, basic research in universities and the system of advanced education in the natural and social sciences. The Panel has adopted a provisional working definition of "health": "the capacity of the U.S. science and technology enterprise to develop new knowledge and insights both for their own intrinsic values and for the contribution they can and should make to the solution of some of the major problems which face mankind and the nation." However, the Panel would welcome suggestions for a better definition.

Currently the Panel is engaged in defining the scope of its work and setting priorities for its study agenda. Some of the issues that may be considered include the following:

— The development of objective criteria for assessing the health and performance of the science and technology enterprise, including its ability to maintain its capacity into the future;

— The validity of current national R&D priorities including priorities in fundamental science, taking into account both future social needs and probable scientific and technological opportunities. The issue involves the development of more systematic criteria for assessing scientific and technological priorities.

— The functioning of the overall research enterprise as viewed from the perspective of the working scientist: whether he is working on the problems that he considers most important and interesting, whether he has the freedom and opportunity to use his maximum capacities and training, how he views his relationship to society and to social priorities.

— The appropriate differences in role and conditions of motivation and reward for scientists and engineers in academia, government, and private industry, and the degree to which these differences are realized in practice.

— The proper balance between scientific freedom of the investigator and the professional obligations of the scientist for the consequences of his work and for communication with the public and with decisionmakers in industry and government.

— The responsibilities and rights of scientists when their obligations to their employer and to the broader society appear to come in conflict.

— The proper relationship between research and higher education; the degree to which research should play a role in universities and which aspects of research needed by society would best be conducted by non-academic institutions, private or governmental, specifically configured toward meeting certain social needs and specific or technological opportunities.

— What alternatives might and should exist to the present traditional basic research and teaching careers for scientists and engineers who are trained to the Ph.D. level primarily through research apprenticeship.

— The nature and existence of a "critical mass" effect in various disciplines and fields of research, and whether the present national research effort in various fields is too concentrated or too dispersed for optimal use of available resources.

— The future role and form of broad-purpose national laboratories, and the specific requirements for a healthy and socially useful national laboratory system, including relationships with universities and industry.

— Whether the present system of graduate and postdoctoral training tends to produce too many people trained in currently fashionable fields to the neglect of other fields of greater potential intrinsic interest or social importance, or whether the adaptability of highly trained people combined with "market" forces in the broad sense will remain sufficient to insure a reasonably optimal allocation of technical manpower in the long run.

— The proper allocation of government support among: specific project grants to individual investigators, general research support to institutions, and support for individual scientists on the basis of promise and accomplishment with review of performance largely after the fact.

— The equity of access to the career opportunities provided by the scientific and technological system on the basis of capacity to contribute.

— The impact of trends in the movement of scientists and engineers between the U.S. and foreign countries, both developed and developing, and what steps if any should be taken by the national government to influence such trends.

Communications and suggestions from persons in the technical community or from the general public concerned with the health and impact of science and technology would be welcomed by the Panel. Such communications should be addressed to Harvey Brooks, Chairman, OTA Panel on the Health of the Scientific and Technological Enterprise, Aiken Computation Laboratory 226, Harvard University, Cambridge, Massachusetts 02138. □

1976 PUBLIC SERVICE AWARDS: BETHE AND KENDALL

On December 18, FAS made two Public Service Awards. One was to Hans A. Bethe for a career of service to FAS and for his activities on a number of issues: science, arms race, and reactor-related debates especially. The other was to Henry W. Kendall for sparking the public airing of important technical issues related to reactor safety.

The citations read as follows:

HANS A. BETHE

A Scientist For All Seasons

No American scientist is a better model of the attributes to which FAS aspires than Hans A. Bethe.

There is, first of all, his supreme excellence in science. Known for his encyclopedic knowledge, breadth, thoroughness, and clarity of style, his important contributions cover more than a half dozen distinct areas of theoretical physics. He is a Nobel Laureate's Nobel Laureate.

There is, second, his dedication, over a generation, to concern with the implications of nuclear weapons. Accurately predicting in 1946 the slim five-year lead over the Russians held by our atomic bomb program, he had the courage in 1949 to oppose developing the hydrogen bomb simply as a response to the Soviet A-bomb. In 1958, his theoretical work as a member of the U.S. delegation to Geneva on the Test Ban was extremely important. It was his subsequent advice on the feasibility of a nuclear test ban that balanced the advice of Edward Teller and — as President Kennedy observed — made it possible for the President to make up his own mind; this he did by siding with Hans Bethe. Again, in the late sixties, his opposition to the ABM was very important and completely vindicated.

Above, and below, and around these issues has been a great deal of educational work in Government, and before the public, on the hazards of nuclear weapons. It is characteristic of the respect in which he and his work are held in this field that he should be the long-standing Chairman of the Board of Sponsors of the *Bulletin of the Atomic Scientists*. And it is symbolic that the first public insight into the hydrogen bomb came from his article in *Scientific American*.

We honor Hans A. Bethe not only for his science and his acts of public policy but, especially, for his character: his sobriety, his readiness to respect the views of others, and to reason with them. Hans Bethe is a thoroughly honest man.

Most recent of his acts of courage and conscience has been his struggle to ensure that the use of nuclear power for peaceful purposes did not receive short shrift. When he saw no other senior scientists effectively making the case for nuclear power, he did not hesitate to do so himself, testifying, writing, and organizing in the FAS fashion.

This brief sketch does little justice to his giant career of service to science, to Government, and to the public. We can only despair at approaching the standards Hans has set.

HENRY W. KENDALL

For Sparkplugging the Debate Over Reactor Safety

No one has done more to spark the public airing of important technical issues related to reactor safety than Henry Kendall.

In 1971, he and his associates raised, for the first time publicly, the issue of the Emergency Core Cooling System; that report, "Nuclear Reactor Safety — An Evaluation of New Evidence," was the first public technical challenge to the adequacy of the nuclear reactor core cooling systems. The AEC subsequently proposed interim acceptance criteria for these cooling systems. Henry Kendall and his associates then issued "A Critique of the AEC Interim Criteria for Emergency Core Cooling Systems." In the process, he unearthed similar concerns within the AEC and its technical laboratories.

The AEC response was comprehensive national rule-making hearings. In those hearings, Henry Kendall served as the scientific spearpoint for the interveners. These hearings made the issues accessible to outside technical review, critiqueing analyses upon which AEC has relied in assessing the effectiveness of emergency core cooling systems. This testimony is found in "An Evaluation of Nuclear Reactor Safety."

On and off the witness stand, Henry Kendall submitted his assertions to public scrutiny and his reputation to public criticism. For seven years, he has catalyzed an enormous debate over reactor safety. Exploiting a sabbatical of one year, but mostly working overtime, he, together with his associates, has forced an entire industry to confront specific issues of reactor safety.

No doubt his conclusions are controversial; after all, the issue is enormously so. And it goes without saying that our 7,000 scientists share no common view on reactor safety. But it is an objective fact that Henry Kendall played a leadership role in the public exposure of an exceedingly important technical coverup.

AAAS COMMITTEE ON SCIENTIFIC FREEDOM AND RESPONSIBILITY INCREASINGLY ACTIVE

A AAAS Committee on Scientific Freedom and Responsibility, chaired by biologist Bentley Glass, has begun functioning.

At its first meeting, the Committee decided, among other things, to collect allegations of political persecution of foreign scientists for its own files, and, in addition, to send such allegations to constituent societies of the same disciplines as those being persecuted, with a covering letter encouraging the society to review the matter and/or to take suitable action.

The Committee has a staff assistant in Rosemary Chalk and is in the process of shaking down, with procedures for subcommittees being determined. The subcommittees with their chairpersons are:

Subcommittee on Infringements of Scientific Freedom in Foreign Countries (John Edsall); Subcommittee on Infringements of Scientific Freedom in the United States (individual appeals) (Jeremy Stone); Subcommittee on Professional and Social Responsibilities of the Scientist (Frank von Hippel); Subcommittee on Boundaries of Scientific Freedom — Ethical and Legal Limits (Harold Green); Subcommittee on Freedom of Science Teaching (William Bevan).

Other individual committee members currently include Jessica Tuchman, Peter Petkas, William Carey, M. King Hubbard, Charles Mosher, Joel Primack, Dael Wolfle, Jane Oppenheimer.

COUNCIL DECIDES NOT TO AFFILIATE WITH WFSW

In September, the FAS Director attended the 30th anniversary meeting of the World Federation of Scientific Workers. In response to its suggestion that FAS affiliate or associate itself in some other way with WFSW, a detailed report of the WFSW was prepared and sent to the members in the November *Report* with a request for member advice.*

About one hundred members responded. A third of the responses strongly opposed affiliation; a third supported affiliation; and a third suggested that some informal communication might be the most appropriate course.

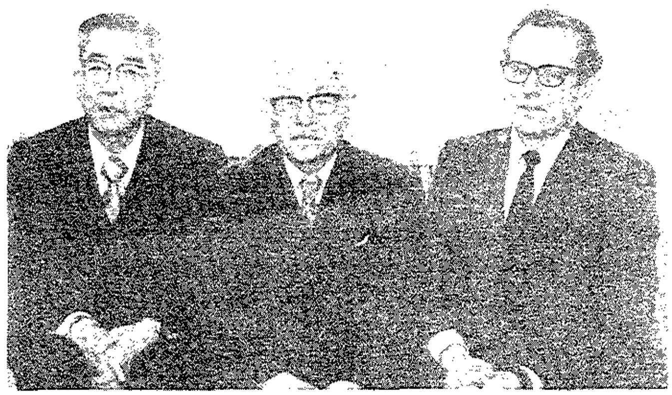
At its December meeting, the Council reviewed the responses and other WFSW material and decided that FAS ought not, in general, be closely associated with international organizations. It therefore rejected affiliation or even permanent observer status. It did authorize the Director to observe on an ad hoc basis when invited, and when he desired to attend or to send a representative.

UNUSUAL APPEAL RE KOVALEV RECEIVED

In November, FAS received an appeal signed by 21 Soviet scientists requesting the release of Sergei Kovalev. It closed by requesting biologists to withhold scientific contacts with the Soviet Union until Kovalev was released. Signed by Andrei Sakharov, Yuri Orlov, Mark Azbel and others, it observed:

> In the camps, they are trying to 'rectify' Kovalev's convictions by isolation, hunger and humiliation. A renowned scientist, he is forced to do exhausting monotonous physical work . . . Malnutrition also is one of the 'rectifying' measures; . . . Kovalev is constantly prosecuted by the camp administration. He is not given qualified medical treatment and has no possibility to cure a painful chronic disease which makes his life as a prisoner unbearable . . . □

*Among minor errors in that report, the Executive Director of the American Association of Scientific Workers is a biochemist at the University of Pennsylvania School for Veterinarians; he is not himself a veterinarian. The Director, Dr. Robert J. Rutman, writes that the organization "was decimated by Cold War repression and McCarthyism," not, as had been reported, by the Stalin-Hitler Pact, which afflicted, to the best of his knowledge, a trade union predecessor. Dr. Rutman represents the AASW on the WFSW Executive Council. Despite the decimation to which he refers, there have been AASW activities, he notes, "with irregular frequency over the past decade."



Takeshi Araki, Yoshitaki Morotani, Jeremy J. Stone

MAYORS OF HIROSHIMA AND NAGASAKI VISIT FAS

On November 27, Mayor Takeshi Araki of Hiroshima and Mayor Yoshitake Morotani of Nagasaki visited Washington as part of a trip to New York to persuade the United Nations to press for elimination of all nuclear weapons and to publicize the effects of the bombings. While in Washington, they visited the Arms Control and Disarmament Agency, the National Archives, the Kennedy Memorial and FAS.

At FAS, the mayors exchanged views on nuclear issues with the FAS director, who read this statement, which had been authorized by the FAS Chairman:

"The Federation of American Scientists, which began in 1946 as the Federation of Atomic Scientists, welcomes the mayors of the cities of Hiroshima and Nagasaki to our headquarters. We wish the people of Hiroshima and Nagasaki to know that our organization has been working for thirty years to prevent nuclear weapons from ever being used again. We deeply regret the suffering, loss of life, and destruction caused by the two atomic weapons used in World War II against Hiroshima and Nagasaki. We hope that representatives of these two great Japanese cities will visit us more often so that, together, we can work to achieve the abolition of nuclear weapons."

As a token of respect for the mayors and for their cities — destroyed by bombs which founding FAS members had helped create — FAS rented a chauffeured limousine to show them the sights around Washington. □

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