Historian of Science States Case for Catching Up on Basic Research

Derek de Solla Price, historian of science and a chief expositor of the phenomenon of exponential growth in science, took the occasion of a congressional hearing held at the AAAS meeting in Washington to pronounce such growth at an end. Ironically, Price provided some living evidence for his thesis; his own department at Yale is being phased out as an economy measure (see page 1189).

The hearings, a first for AAAS, were held jointly by the science subcommittees of the Senate Commerce Committee and House Science and Technology Committee. Senator Adlai Stevenson III (D–Ill.) presided over the morning session and Representative George E. Brown, Jr., chaired the afternoon session.

Price's testimony was an updated statement of the traditional case for support of R & D, particularly of basic research. But it also had some of the flavor of Frederick Jackson Turner's valedictory on the passing of the American frontier and a dash of Oswald Spengler's *Decline of the West*.

What happened, said Price, was that in 1967, "at least three long-term progressions of our society came simultaneously to a screeching halt when the brakes were slammed on at a blank wall of total impossibility of future growth."

The three culminations Price noted were the practical termination of the movement of workers out of agriculture, the end of the expansion of universities, and the plateauing of R & D expenditures.

For 200 years, says Price, agricultural workers have moved into industrial production and service industry at an average annual rate of 0.5 percent of the labor force. By 1967, "agriculture had been reduced to a virtual minimum of a tiny fraction of the population. Since then the only change possible has been a slow transformation from industrial production to service industry."

Describing what he called "the saturation of higher education," Price said that around 1967 the universities and colleges which had been growing for more than a century from elitist education to a democratized university system came to the stage where half of each age cohort entered college. The intensity of higher education had doubled every fifteen or so years and obviously could never double again. The situation was masked by the Vietnam War crisis in the colleges but the change was sudden. Universities would never expand again and the need for teachers declined sharply from 7–8% per annum to a replacement rate of about 2% per annum. Since college teaching is the major locus of basic scholarship in the nation, this activity suffered a potential slash by a factor of 3 to 4, about half of which has already emerged from the academic pipeline.

Turning to what he termed "the R & D ceiling," Price said, "at the same date, and working on the same population, an inevitable decision had to be made to hold the national R & D expenditure to a ceiling. This expenditure had reached by that time a magic number of about 2½% of the GNP. This proportion had been steadily doubling every fifteen years; it had been only about 1% of the GNP in 1953 and a tiny fraction of a percent before World War II."

Price went on to say that "this peaking out of our national funding in R & D coupled with the problems of a service economy and a saturated university system have the gravest consequences and are probably responsible for a declining economy and increasing inflation and unemployment."

Price observed that federally funded R & D (some $28 billion worth) amounts to about 14 percent of "controllable" expenditures in the total federal budget. "This is a high proportion, about 1/7 of the total expenditure. Essentially, the brakes had to be put on at some point near this, for at the long-term conventional growth rate the entire allocable

FBI—Privacy Fight Flares Up

The Federal Bureau of Investigation (FBI) has proceeded with plans to add a "message switching" capacity to its national computerized crime files, despite previous written assurances to Congress that it would be consulted before any such move was made. The FBI's action seemed defiant enough of congressional prerogatives to spark an angry letter to Attorney General Griffin Bell from three senators concerned with the privacy implications of message switching: James Abourezk (D-S.Dak.), Charles Percy (R-Ill.), and Charles Mathias (R-Md.).

Message switching is the capacity by which the FBI's existing computerized files would also become the central communications point for law enforcement officials around the country to query other jurisdictions about suspects, stolen property, or missing persons. While the FBI has said this would make the criminal justice system more efficient, congressional critics for more than 4 years have been arguing that it would concentrate Big Brother style powers in the hands of the FBI. They say the existing, decentralized telecommunications system used by the states should continue.

The three senators were angered by some recently released documents showing that last December, the FBI issued a request for proposals to computer companies to bid on new equipment to upgrade the National Crime Information Center (NCIC), the central data bank in Washington that now contains both the FBI's records and those of about a dozen states. Among other things, the FBI request asked bidders "to include in their proposals the hardware and software components necessary for message switching."

But at the same time the request was working its way through channels at the FBI and General Services Administration, two high-level officials in the Justice Department gave written assurances to Representative John Moss (D-Calif.) that "approval" from Congress would be sought before the department, which includes the FBI, took "any initiatives" on message switching.

Spokesmen at the FBI note that although the request asked for hardware and software, they will be bought only at a later stage, after the Attorney General's approval has been obtained. Staffers for the interested congressmen say, however, that the government should not start procuring such equipment before a policy decision on message switching is made.

—DEBORAH SHAPLEY

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budget would have been eaten up by the year 2000, with nothing left over for other governmental activities. The Mansfield Amendment in 1967 caused the cutoff to be very abrupt, but it would inevitably have happened anyway."

Price argues that the crucial portion of the national R & D budget—a total of about $40 billion including private sector expenditures—is the roughly $4.7 billion which goes to universities and nonprofit organizations. "This is the sum," says Price, "which is invested by the nation in keeping up and participating in the world's acquisition of new knowledge and new techniques. It is our major investment in generating innovations which are the mainstay of the international trade that governs our wealth relative to that of other countries, and it is the only chance we have to train people in new knowledge and techniques, at present unforeseen, but needed in the future, to increase and even to preserve our quality of life."

About half this sum goes into biomedical and biochemical research directed at combating disease. The rest covers everything else.

Price sees the result of this peaking out

"New Wave in Academia" Wipes Out Department at Yale

Yale's department of History of Science and Medicine was established in the late 1950's when universities were expanding and the post-Sputnik spirit favored most things associated with science. Last year, as a sign of the times and of the state of university finances, the department was put on notice that it would be phased out.

The department is a small one. It now has three faculty members, all of them tenured full professors and all—Asger Aaboe, Martin J. Klein, and Derek de Solla Price—highly regarded in their discipline. There has been no threat to tenure for any of the three and current graduate students have been assured they will be able to complete work on their degrees. But History of Science and Medicine will cease to exist as a full-fledged department with its own graduate program. Negotiations are under way toward fashioning of an arrangement to keep the three professors working in association, but the details are not settled.

It is generally agreed that the department is a casualty of the financial stringencies afflicting Yale. Observers familiar with events, however, say the initiative for change originated in the School of Medicine, which has been the department's institutional base. There was a feeling in the medical school that it was anomalous to lodge a department with a majority of senior faculty whose interests lie in the physical sciences and mathematics. Charles Rosen, a fourth professor in the department, whose field was history of medicine, was scheduled to retire but died suddenly last year. The medical school was said to want to deploy the vacant professorship in a subject such as the ethics of medicine.

The decline in the department's fortunes apparently began in the 1972–1974 period when Yale made a series of faculty cuts in the interest of economy. Deputy Provost for Science Charles Bockelman says that the status of History of Science and Medicine was reviewed and a decision made to make no further appointments of junior faculty. He says that it was recognized then that "the academic and scholarly qualities of the individuals involved was very high," but for the university, "it was not possible to do everything you'd like to do."

Consideration was given then to disbanding the department, says Bockelman, but Yale's president at the time, Kingman Brewster, saw some hope that funds might be raised to save the department so final action was not taken. The university subsequently was not able to find the required resources and the matter again came up about a year ago.

In February 1977, a committee was formed to look into the future of the department and Aaboe, Klein, and Price were told not to admit new graduate students for the fall of 1977. In April, department members got a letter from Yale's provost and acting president, Hanna H. Gray, saying that she was recommending to the Yale Corporation that the department be phased out, and shortly afterward she informed them that the recommendation had been approved. At the same time a letter went out to applicants to the department from the dean of the Graduate School, Jaroslav Pelkian, saying that Yale would no longer admit graduate students to work in the history of science.

Despite this apparently definite word, a period of confusion ensued. Department members had the impression that the action might not be final, perhaps because communications with the administration were not at their best. Yale was in the midst of its protracted search for a president to replace Brewster, severe financial problems were occupying administrators, and a bitter strike by blue-collar workers was impending. Department members never did see the report of the committee formed to examine its future. And there were protests and appeals from outsiders and colleagues in behalf of the department, some of the latter apparently disturbed at the portents for themselves of the disbanding of the department.

Lately, the administration has moved to conclude a compromise arrangement. The three professors reportedly would leave their present quarters for offices in a house on the fringe of the science area of the campus. The three would continue to offer undergraduate courses under their collective aegis. Although the departmental graduate program will be dismantled, the door will be left open for graduate students to work in history of science under arrangements with other departments with which the three have links. Aaboe has ties with the mathematics department and Klein with physics, but this leaves Price at loose ends for the moment.

University officials see formation of a "committee" or "consortium" on history of science as the organizational solution. Price, who has an eye for trends, foresees the possibility of an institute in the subject. He thinks that what happened to his department represents "the leading edge of a new wave in academia." External forces are closing down many programs and he hopes that his own department can provide a model alternative. An institute would provide a place for able postdocs and junior faculty forced out of the shrinking universities. Federal and foundation funds would have to provide support for these "academic refugees," says Price. But institutes of the sort he advocates would enable the best of the young scholars to survive the new occupational hazards of academia.—J.W.

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of funding 12 years ago as "underinvestment in the future" and a "loss of the U.S. empire in science and technology." For more than a decade, says Price, "academic research in science and technology has been running effectively at half speed compared with the world growth rate of a 6% per annum increase in scientific and technological activity. Many of the other most developed nations of the world have followed our lead a few years later, but still, relative to the rest of the world, the United States is falling back at about 3% per annum. It is this loss in our 'scientific and technical empire' [I make an analogy with the loss of British empire which I experienced in my youth] which makes itself felt in the adverse balance of our dominant high technology international trade and thereby devalues the dollar in the world exchanges.

"In 1967, at peak, the United States was about 33% of all world science and technology across the board. The decline, due to saturation at the previously mentioned 3% per annum, has been producing a 1% fall in our share of the world's science and technology every year and we are now, so far as I can make a guesstimate, only about 25% world science. Since the United States has only about 7% of the world population, one can express these figures by saying that at peak in 1967 we had about five times the average share of world affluence or per capita GNP. It is now, in 1978, about 3½ times the average and unless heroic measures are taken we will have been reduced to only about double the world average before the year 2000 A.D."

Before taking such "heroic measures," Price thinks that a useful first step would be to "disaggregate" the basic science budget which is now combined with other items, including technology purchases and civil service science, to form a "dangerously misleading aggregation." Then he would treat the basic science budget to "moderate increases instead of decline." He sees the 11 percent boost requested for basic research in the Carter budget as helpful but not sufficient. What academic science needs, he says, is funding over perhaps a 10-year period to make up for the cuts it has suffered. To do this would require an increase of 16 percent a year in the academic science budget and, if funds were provided to compensate for a 6 percent inflation rate, Price calculates a 22 percent increase would be in order.

These would be heroic measures indeed, but Price insists that the choice is between such action or rapid decline.

Price's bid for support of basic science was not subjected to questioning by either legislators or his fellow panelists because he departed immediately after giving his testimony. Price, a versatile academic whose interests and expertise range from the development of scientific instruments to the wilder shores of science policy, was scheduled to chair a session on "Science and the Ism's of the 20th Century," set for the same hour.

Challenges to Price's views seem predictable from those who feel that improvement of U.S. performance in industrial innovation is the main problem for science policy today and that heroic increases in the basic research budget are not the way to solve it. Senate staff members say that Senator Adlai Stevenson III found Price's paper provocative, and Price's analyses have a way of getting noticed in academia, so there could be a delayed reaction.

—JOHN WALSH

Patent Policy Changes Stir Concern

Acting on recommendations that date as far back as 1971, the General Services Administration (GSA) has amended federal procurement regulations to permit universities to get a larger share of the commercial benefits of federally financed research.

The new regulations were based primarily on suggestions by a subcommittee of the Federal Council for Science and Technology that greater incentives are needed for universities to pursue commercialization of their research. The GSA regulations would provide this incentive by encouraging federal agencies to allow universities to retain possession and control of their federally financed discoveries; universities, in turn, would be encouraged to license these discoveries to private industry.

Specifically, the regulations provide for a standard agreement between federal agencies and universities, known as an Institutional Patent Agreement (IPA). "The agreements permit . . . institutions, subject to certain conditions, to retain the entire right, title, and interest in inventions made in the course of their contracts" with the federal government.

Such agreements are in common use by federal agencies now, but each may have a slightly different form. The GSA regulations require that all new IPA's, meaning any written or rewritten after the effective date of 20 March, must follow a single standard.

Moreover, the standard specified in the regulations is different from the IPA's being used now in several respects, according to several federal patent officials.

1) The new IPA can be used to cover research funded through contracts as well as grants.

2) The new IPA increases the period of exclusive control that a university can give to a licensee from 3 years after the initial marketing of a product to 5 years after the initial marketing.

3) The time that a licensee spends trying to get a federal regulatory agency to approve the product will be exempted from the time limits on exclusive marketing.

4) It permits universities to affiliate with for-profit patent management companies, which are organized to promote the licensing of university discoveries to private industry.

5) It removes the ceiling on the amount of royalties from a discovery that can be returned to the researcher who invented it, essentially allowing each university to set its own policy on the amounts.

Although this patent policy is intended to facilitate the transfer of research results from laboratory to marketplace, there is some concern on Capitol Hill that it goes too far in the direction of allowing profit-making firms to benefit from federally funded research. Also of concern is a provision that could pressure researchers to withhold publication pending patent filings. Senator Gaylord Nelson (D–Wis.), chairman of the Small Business Committee, hopes to hold hearings before the policy goes into effect next week. If that cannot be done, he intends to ask the Office of Management and Budget to delay implementation until hearings can be scheduled.—R. JEFFREY SMITH

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