

Letters

Ph.D.'s Coming and Going

We support Cartter in his plea (9 Apr., p. 139) for more thorough and objective skilled manpower forecasting. Many of us wince at the inaccuracy of our own assumptions of only 3 or 4 years ago on national needs. At the same time, we see signs of a new public dogma of "gluttism" emerging, which derives from present forecasts that by 1980 there will be 48,000 to 80,000 new Ph.D.'s annually. On the basis of our April 1971 survey of program plans at Wisconsin, we are becoming convinced that these projections are much too high and fail to take full account of the remarkable adjustments that are occurring.

In 1969-70 the University of Wisconsin produced 890 Ph.D.'s, or approximately 3 percent of the national total. We believe that what our own survey shows is probably replicated in the top two dozen graduate schools, which produce more than one-third of the doctorates. At Wisconsin, the rate of Ph.D. output will continue to climb for two more years, reaching a plateau of approximately 1150 in 1971-72. After 1972-73, a decline will begin. On the basis of sharply reduced admissions last year, this year, and in the near future, the decline will continue until at least 1975-76. Estimated intakes of new students reported by our graduate programs will be only 60 percent of the 1968-69 level next year, and little more than half in 1972-73. If these statements of departmental intent are accurate, and we believe they are, then there is simply no possibility that our Ph.D. output in the late 1970's could be much greater than that for last year, as the average elapsed time for the degree is 5 to 6 years.

If there is no increase over present doctoral figures in the top institutions, where will the growth occur? We suggest that the rate of growth in the past decade, which largely occurred through availability of public resources, cannot be sustained in newer or "emerging"

institutions either. Elimination of federal graduate aid programs, and pressures on state fiscal resources to meet spiraling social costs of health, welfare, and urban programs, will not permit funding of graduate expansion, much less the initiation of new graduate campuses. In other words, we would argue the alternative hypothesis: the level of Ph.D. output in 1980 is quite likely to exceed that of the present year only to the extent that emerging institutions can afford the great financial sacrifice of growth with their own funds.

To survive, they must achieve a quality acceptable to students who personally shoulder much of the cost. Any other growth can only occur with funds generated to fill specific manpower shortages or by a reversal of the current strong reaction of state and federal policy to Cartter's important manpower projections.

We have no quarrel with the demand forecasts which Cartter has advanced. But if the supply curve, as we argue, is radically different, then "gluttism" as a public policy determinant becomes less relevant. And if "gluttism" means the sweeping dismantling of public support programs for the training of scientific manpower, then tragic damage may be done in many fields critical to the long-term economic, social, and environmental stability of this nation in a competitive, rapidly changing world.

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Cartter's otherwise very fine paper is marred by his proposal that professors be retired at age 64 or earlier. Presumably he associates didactic capacity with capacity for idiosyncratic "creativity," which is supposedly correlated negatively with age. . . .

According to the 1967 life table a white male retiring at age 60, 64, or 69 years, respectively, could still expect to live 16.1, 13.6, or 10.9 years. The corresponding expectancies for a white female are 20.4, 14.8, and 12.9

years; and for the two sexes combined, 18.2, 15.5, and 12.4 years. Should a white male enter the labor force at age 25 and retire at 60, 64, or 69, he would have worked 2.1, 2.9, or 3.6 years for each year spent in retirement. These figures would be lower for a white female, for a married couple, or for a white male if his life expectancy at birth rose from 67.8 to 74 or more years, as is expected by scientists who believe that by the year 2000, 20 to 24 useful years will be added to the period of middle age. Could a man retiring at age 64 or earlier earn enough to live comfortably in his remaining years, given present or prospective post-retirement life expectancy?

Cartter also suggests retirement at half salary upon completion of 25 years of service, regardless of age. Could he live comfortably on this income? Could or would the economy or those in the lower age brackets sustain such an arrangement? . . . The suggested arrangements overlook the almost inevitable decline in the purchasing power of the pension dollar, probably 2 to 4 percent a year in an economy dominated by Old Politics, New Economics, Big Unionism, Oligopoly, and a wastrel Leviathan. Also overlooked is the denial to the retiree of a share in the increase in output associated with public investment, enough to increase real average income perhaps 1 percent a year if not more. A social credit for the aged could, of course, assure the retiree of this last claim (1).

Given the world in which the individual currently finds himself, only his ability to exercise his right to work is likely to guard him against inflation and other security-eroding forces.

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Reference

1. J. Kreps, Ed., *Employment, Income, and Retirement Problems of the Aged* (Duke Univ. Press, Durham, 1963).

Cartter's dismayed analysis of the future manpower situation in American colleges may be extended to one more dismal point. Data from his table 2 (showing the number of full-time faculty members "needed to maintain present quality of instructional staff" in the next two decades) allow construction of Table 1 if we assume that (i) new people enter faculty positions at age 28 and (ii) faculty members who

Table 1. Faculty (thousands) changes projected for 1972-1990.*

Year	Total full-time faculty (projected)	Net increase in faculty ages 40 to 65
1972	336	3.8
1973	351	4.5
1974	365	9.6
1975	380	8.5
1976	394	14.6
1977	406	9.6
1978	417	8.7
1979	427	13.1
1980	437	14.5
1981	445	10.6
1982	451	7.1
1983	452	15.3
1984	446	14.0
1985	436	13.1
1986	423	13.1
1987	411	13.6
1988	405	13.9
1989	405	12.0
1990	408	10.6

* Over the period 1982-90, while the total full-time faculty decreases by 43,000, the number of professors in the 40 to 65 age group increases by 105,600. There is substantial opinion that researchers in their 40's are past their prime, particularly in the hard sciences and mathematics. If this is true, and if the numerical projections hold, then the 1980's may be the beginning of a period of relative intellectual stagnation in American higher education.

leave (retire, die, or leave for other reasons) are over age 40.

Cartter suggests that retirement age be lowered to 64 to make more room for younger people. This is a move in the right direction, but a 1-year reduction is not sufficient to prevent the impending aging of our faculties. Why not make the retirement age 60 or even 55? Pensions could be adequate, efforts could be made to place these retired people into useful activities outside academia and, as Cartter suggests, those older professors who are still quite lively could continue on annual appointments. The benefit of a lowered retirement age would be to break the tenured hold of unproductive older professors on scarce faculty positions.

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Although the letters from Spengler and from Mazur and Einhorn seem contradictory, I have strong sympathies with both points of view. Mazur and Einhorn are rightfully concerned with maintaining institutional vitality in the next two decades. Higher education and research could stagnate if we do not find some means of making room for a constant influx of bright young schol-

ars. Expansion of the market has long provided that opportunity, but the next 20 years could make the colleges look more like the American railroad today.

Spengler is concerned with the individual's welfare and his potential contribution. I was not suggesting that after 25 years of labor a man should be put out to pasture or advised to pursue Golden Age Club activities. Rather I believe that a faculty should have the option of replacing a colleague who has not retained his scholarly prowess after 25 years, and that all professors should have the option of seeking a new career or opportunity for service without major financial risk. As a long-time colleague of Spengler's, I know that he will never retire as a scholar whatever the rules; I would be a charter member of the Spengler-for-Congress club and count it as a social benefit if he would turn his talents and zestful spirits to other forms of public service upon retirement as a professor.

I thoroughly share Bock's concluding sentiments and have pleaded for an understanding and sustaining federal policy. To date, this has been in vain, and I fear that several major universities may be destroyed before a positive response is forthcoming. I wish I could be as optimistic as Bock about the possibility of stabilizing (or even modestly contracting) doctoral output in many fields. Wisconsin has been better than most states in preventing the proliferation of graduate programs, but the experience of many other states with aspiring younger universities does not give me a sense of optimism.

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Solar Eclipse Information

L. J. Robinson's letter ("Another eclipse in 1973," 26 Feb., p. 751) prompts me to ask *Science* to publish the following information.

The National Science Foundation is making plans to coordinate activities connected with the June 1973 total solar eclipse which will occur across central Africa. The foundation will provide services similar to those rendered for the 1966 and 1970 eclipses and plans to have a site-surveying party visit Africa this summer. A report of planned coordination activities was presented at the International Sym-

posium on the 1970 Eclipse in Seattle, Washington, 18-21 June 1971.

Responsibility for the program within the National Science Foundation has been assigned to Thomas B. Owen, Assistant Director for National and International Programs. Limited support for university scientific efforts will be provided by the Astronomy and Atmospheric Sciences Sections of the Research Directorate, headed by Edward C. Creutz, Assistant Director for Research. Information concerning the eclipse can be obtained from Ronald R. La Count in the Office of National Centers and Facilities Operations (202-632-5712).

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Averting Nuclear Blackmail

Concerning the dangers inherent in large-scale processing and movement of nuclear fuel (News and Comment, 9 April, p. 143), I believe that it is not "reactor proliferation," as such, that threatens but our way of going about it.

The prospects for illegal diversion of special nuclear materials and their use by nations or groups for nuclear blackmail or worse have long been recognized by those of us who work in the nuclear fuels field. The way to minimize this problem also has been apparent for some time: use nuclear fuels in a fully automated, closed cycle, energy extraction process, with on-site reprocessing as an integral part of the cycle. It is well within the capability of current technology to deliver new fuel to the nuclear electric plant, to burn and breed in the energy extraction step, and to reprocess, refabricate, and recycle on site—nonfuel by-products and wastes being eventually shipped out. Obviously, this will also reduce the potential threat to the environment by allowing low-value spent wastes to age and cool over longer periods of time before they are transported.

The current trend toward large, regional fuel-reprocessing plants coupled with endless patterns of fuel transport—from initial processor to enricher to fabricator to user to reprocessing plant (to Tinkers to Evers and, very much, to Chance)—is both illogical and, in the long run, uneconomic, as many