Letters

NSF Materials Funding

As current chairman of the DEPTH committee (*1*), I feel impelled to express at least my personal opinions concerning the 29 July testimony before a subcommittee of the House Science and Technology Committee by Doris Kuhlmann-Wilsdorf on the funding patterns of the National Science Foundation's (NSF) Division of Materials Research, as reported by Deborah Shapley (News and Comment, 22 Aug., p. 622).

The validity of the conclusions drawn by Kuhlmann-Wilsdorf from her statistical study of the funding patterns is open to serious doubt for two major reasons. The first is her highly questionable use of the first-name citation index as a measure of the quality of university materials departments. That such a measure gives a distorted view of department quality is attested to by, among other things, the list of the ten best materials departments to which Kuhlmann-Wilsdorf's measure leads, as presented in Shapley's article. I am convinced from some 30 years of close contact with the materials community that at least four, and possibly six, of these departments would not come close to being rated among the top ten if the opinions of the members of the materials community were polled. Two of the ten—Harvard and the University of Maryland—do not even have such departments.

The first-name citation index may be expected to be a poor indicator of department quality because there is a wide disparity in practice among faculty members in the determining of whose name goes first on a multiauthor paper. Most often it is the custom to place the names of graduate students and postdoctoral students first. As a result, the first-name citation index is probably meaningless as a measure of the research effectiveness of the faculty members concerned. Also, many departments in which excellent research is done, but in which undergraduate programs are nevertheless emphasized, cannot compete in quantity of research with those that do not undertake undergraduate training. To deny research funds to the former on the citation-index basis would be to cut off the vital supply of B.S. graduates. The trend toward using the first-name citation index as a measure of quality is entirely deplorable. If encouraged, it will inevitably lead to the almost uniform appearance as the first name on papers of the name of the investigator with the most "clout" in a given local group. This in turn will militate against the development of new, young researchers; it will also tend to seriously reduce the number of joint research efforts and, thus, the very important synergistic effect of such efforts on the amount and quality of research done.

The second major reason why Kuhlmann-Wilsdorf's conclusions are doubtful is her assumption that science will serve the United States best by moving toward an elitist national scientific effort. Leaving aside the complicated political and philosophical questions that such a policy raises for a democratic society, it is not at all obvious that an elitist state of affairs produces the best science and technology. The history of science is replete with instances where an established elite has delayed for long periods the introduction of important new ideas and developments. Further, irrespective of the truth of the arguments presented in the Kuhlmann-Wilsdorf testimony and the Shapley article in *Science*, concerning NSF's alleged "populist" distribution of materials research funds, NSF's research support of the Materials Research Laboratories (MRL's) at some 15 universities is not "populist." These 15 universities receive a large proportion of the research funds distributed by the NSF's Division of Materials Research, and much of this is effectively funds for which the MRL's do not have to compete directly "on the open market." This policy (inherited by the National Science Foundation from the Advanced Research Projects Agency) has created an elite in the materials community in that the MRL universities, tend to be able to more easily buy the best equipment and facilities, attract the best faculty and, in turn, the best research students, followed by a big advantage in attracting more funds, and so on. A good case can be made for NSF support of such institutions, partially on the basis of the elitist ideas of Kuhlmann-Wilsdorf, but the optimum proportion of such support in the overall NSF materials research funding may or may not coincide with NSF's established ratio. At any rate, its existence clearly demonstrates NSF's recognition that special support of excellence in science is desirable. The difficulty, of course, is that, as in all areas of human endeavor, there is the inevitable disagreement on what and whom should rate that special support.

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Notes

1. The DEPTH committee is a group made up of all the department heads of university materials departments (metallurgy, ceramics, and polymers) throughout the United States.

Stimulating Technological Innovation

Jordan Lewis (Letters, 22 Aug., p. 593) indicates that ETIP (Experimental Technology Incentives Program) at the National Bureau of Standards is the *only* federally sponsored technology incentives program now operating. However, the National Science Foundation's ERDIP (Experimental R & D Incentives Program) is still in operation, contrary to Lewis's allegation. The Innovation Center at the Massachusetts Institute of Technology (MIT), established in 1973 under a cooperative agreement with ERDIP, performs the function of "demand-pull" in a teaching atmosphere. Several projects have already resulted in marketable products, and quite a few young entrepreneurs and innovators have begun to take their first steps. In addition to the MIT Innovation Center, ERDIP also has centers at Carnegie-Mellon University and at the University of Oregon.

Lewis's ETIP appears to be a most interesting program with considerable potential. Since this kind of program is still in the infant stage, we can all benefit from learning from one another.

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Population Control

The relevance of previous European experience for Third World policy concerning population growth and development is correctly questioned by Michael Teitelbaum in his critique of the "demographic transition theory" (2 May, p. 420). But he does not consider contemporary experience in the Third World itself and is puzzlingly inconclusive about what policies are most appropriate at present. By implication, in his rejection of the theory of transition, Teitelbaum endorses population control measures as an alternative

policy. Moreover, he ignores much recent thinking on the most fruitful meaning and means of "development."

Teitelbaum usefully challenges any who argue that "development will take care of population problems," thanks to an eventual demographic transition resulting from increased per capita income, education, urbanization, emancipation of women, and so forth (following the developmental pattern of Europe). Any who advocate simply accelerating development by conventional means misread experience in both the First and Third Worlds. But the strong implication of Teitelbaum's argument is that population control should be pursued actively, and he does not suggest anything different from the existing programs of family planning education and propaganda, distribution of contraceptives to the poor, incentive payments for vasectomies, free abortions, and so forth.

The policy choice to be made is not as restricted as one would infer from his article. The choice is not just nonintervention or intervention to reduce fertility. Discrediting a "pronatalist" position does not prove an "antinatalist" one. In particular, a more sophisticated version of the demographic transition theory finds some support in evidence from the Third World itself. Proponents of this approach do not necessarily reject population control measures, but see them as definitely subsidiary and only supportive of more basic policy undertakings. They contend that it is not "development per se" which will make a difference in demographic trends, but the *pattern* of development which is sought and achieved.

The demographic transition theorists have shown that, when per capita income reached levels of $600 to $1000 in Europe, fertility declined. Truly, as Teitelbaum notes, it will be a long time before incomes in the Third World reach these levels, and if fertility continues at present rates only misery can lie in store for most or all the world's people, regardless of the social or economic systems adopted. But it has been observed that a number of countries have begun to reverse their rate of population growth already at per capita income levels of $150, $200, or $300 in conjunction with strategies of development that stress not just aggregate per capita income growth—by expanding mostly the "modern" or industrial sector—but rather promote development particularly of agriculture and rural areas.

Through land reform and other rural development efforts, expanded educational opportunities, extended health services and other amenities, and systems of local organization, such as local government or cooperatives, a number of countries have pursued more equitable patterns of development over the last 10 to 20 years than are found in most of the Third World. These countries have had marked reductions in fertility. A diverse set of countries culturally, economically, and politically fit this pattern—China, Costa Rica, Cuba, Egypt, South Korea, Sri Lanka, and Taiwan. (It should be added that most of them have also undertaken active family planning programs in rural areas as an adjunct to their other efforts. China's efforts to contain population growth have been probably the most strenuous of all.)

The more equitable development strategies in these countries have provided the equivalent socioeconomically of what occurred previously in Europe—improved living standards, education, security, opportunity, and so forth. Given the distribution of benefits in the pattern of European development, concentrated in the industrial-urban sectors, national per capita incomes generally had to reach an average of $600 to $1000 before the rural majority began to receive much improvement in income or welfare. But with policies having more widespread impact, these improvements can be brought to rural families—who produce the large majority of children in Third World countries—when their incomes are considerably lower than the national average.

The best analysis of these issues and the relevant data is by James Kocher (*1*). While this approach is still not as conclusively documented and tested as the demographic transition theory, and may also be mistaken or applicable only in a limited set of cases or circumstances, it is a position which should be taken more seriously by "antinatalists." For those who reject population programs outright and believe simply that development will take care of population growth, I recommend the thoughtful and critical article by J. Mayone Stycos, "Demographic chic at the UN" (*2*).

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References

1. J. Kocher, *Rural Development, Income Distribution and Fertility* (Population Council, New York, 1973).
2. J. M. Stycos, *Fam. Plann. Perspect.* **6**, 160 (1974).

Unhappily, Uphoff has read more into my article than was written. His letter is sprinkled with the key phrases "by implication . . . ," "the strong implication of . . . ," and "one would infer from. . ." On the basis of these assertions, he interprets the article as supportive of "active population control" similar or identical to existing programs of family planning education and propaganda, distribution of contraceptives, incentive payments, free abortions, and so forth. In contrast, Uphoff argues for more equitable patterns of development such as those in China, Costa Rica, Cuba, Egypt, South Korea, Sri Lanka, and Taiwan, which he believes have had major impacts upon fertility.

In view of these comments, I am obliged to make the perhaps obvious points that my article was not written in support of existing family planning programs, nor was it concerned with the relative desirability of particular courses of development. The subjects of the article were the theory of the demographic transition, the historical record of development in its theorized relation to fertility decline, and the degree to which relevant circumstances of developing countries are similar or different from those of 19th-century Europe. I would find a tightly argued article on the effects of alternative models of development upon fertility decline to be of considerable interest, but this would be a different article from my own.

Happily, despite Uphoff's misinterpretation of my argument, I have no real quarrel with his views on what the proper course of development *ought* to be in developing countries in the future. Indeed, I believe there is a quite plausible (if not yet proven) relationship between the pattern of development and the course of demographic rates. It must be emphasized, as Uphoff does, that most of the countries to which he has referred as models of more equitable development are also those which have undertaken active programs of population policy. These efforts include not only the more traditional programs to which Uphoff refers, but also less traditional approaches "beyond family planning," such as societal efforts to raise the age of marriage, changes in taxation and housing policy, and the use of intensive community pressure upon couples to restrain their fertility. Perhaps the most vigorous population policies of this type are those of the People's Republic of China, whose antinatalist policies are fundamental components of its overall development efforts, despite its "anti-Malthusian" rhetoric.

Uphoff's letter illustrates well the truism that those who are sincerely concerned with population and development processes must reject the simplistic "either-or" in favor of more complex and interactive views which better reflect the realities of the modern world.

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