The latter are the recognized authorities in their fields. They know because they do. And others recognize that they do. I don't think the dichotomies university-industry or big-little (science) have much to do with the distinction between basic and applied science (look at the author bylines in the journals). Decisions based on this distinction should be made by, or at least in consultation with, the individual recognized researchers.

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. . . While exploring the quicksand between particle physics and building better mousetraps, the classical boundries of research and science are left unperturbed. Science is that on which research is done; science and research involve things hard enough to stub one's toe on . . . a Spinco, a microscope, or a mousetrap. To me, research is the Almighty Scientific Method in action, and if this is true, objective evaluation of a teaching program or a systems approach to delivery of health care are as much research and as much science as a frontal attack on the mystery of the gene. Classical research and science they are not. But the more that research, education, and service are considered as functional aspects of the same animal, the easier it becomes to measure the dollar value, or applicability, of the total effort. At one extreme, a study may involve no more service than providing jobs and no more education than how to operate an electron microscope. At the other, where students are involved in research on a problem of local service, the learning, discovering, and helping have a positive feedback relationship toward each other. The value of the system includes the people in it. . . .

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Statistical Randomization in the Behavioral Sciences

In his letter (24 Feb.) Stanley takes issue with my protest (Letters, 21 Oct.) against the invalid uses of inferential statistics in studies employing (i) nonrandom samples and (ii) nonrandom assignment of experimental treatments to sample units. According to Stanley, "hypothesis testing in studies involving nonrandomly chosen 'grab groups' is feasible. If it were not, the results of many comparative experiments in the behavioral sciences would be difficult to interpret statistically, because any differences whatsoever might be attributed to chance fluctuations."

The invalid use of inferential statistics *is* feasible, possible, and, indeed, popular in the behavioral sciences. I hasten to agree with the consequence Stanley points out: many studies *are* "difficult to interpret statistically." But this is because these "quasi-experiments" to use Stanley's term ("pseudo-experiments" might be less misleading) violate the assumptions of inference. Descriptive statistics are perfectly appropriate in these studies, but inference to other populations is a matter of opinion or authority rather than statistics.

In the field of educational research to which Stanley addresses his remarks, these violations have led to seemingly endless series of equivocal, nonreplicable studies. Important questions such as the effect of class size and teaching methods on student learning remain unanswered. Instead of tightly controlled, randomized experiments, investigators continue to pursue statistical significance with ever larger samples in quasi-experiments. In addition, the generality of other nonrandom behavioral science research for human affairs is open to question, especially if the rest of us do not behave like white rats, pigeons, college students, pig-tailed macaques, or Maori tribesmen.

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Growth Incentives in the "Have-Not" Nations

In his address delivered at the December Washington meeting of the AAAS ("The ever widening gap," *Science*, 24 Feb., p. 959), Blackett reiterated the prevailing and plausible opinion that the population problem in the poor countries in the South is due to the export of modern medicine by the rich countries in the North, which has resulted in health, too much and too soon, rather than wealth.

On the basis of simple arithmetic, it may seem plausible to construe a

reduction in mortality as the cause of the population problem, if the problem is viewed simply in terms of the rate of population growth. But certainly the solution of the problem is not simply the achievement or maintenance of a low growth rate, which could be the result of a balance either between high or low birth rates and death rates. All humanitarian considerations aside, only low death rates matched by low birth rates will maximize the returns from investments in human resources and minimize the ratio of dependents to producers.

The beneficial effects of health services are still achieved in synergism with other improvements in the levels of living (*1*). In a reciprocal cause and effect relationship, mortality declines with economic development. The extension of health services is a necessary but insufficient condition for health, which is a necessary although insufficient condition for productivity. Reductions in mortality have always preceded reductions in fertility. Recent evidence confirms that a reduction in mortality is a necessary, although insufficient, condition for a reduction in fertility (*1*). As mortality declines and the population growth rate increases, there also develops a trend toward restraining fertility. Of course, the desired demographic changes are no more automatic than the desired economic changes. The use of the most efficient, effective, and acceptable methods of family planning would seem to be the most appropriate response to the spontaneous motivation to limit family size.

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I was present when Blackett presented his address. Reading his article in *Science* has not changed my first impressions. His analysis and statistics on the low rate of increase of the gross national product in such countries as India, while impressive, end with the usual conclusion that the solution lies in doling out more aid from the "have" to the "have-not" nations.

Blackett's analysis omits the human factors that have much to do with the productivity of any people. Certainly the most important and enduring factor affecting the gross national product is that people work harder and produce more when they are assured profit and personal gain in proportion to effort and to innovation. This is even more true in the "poor" countries than in the "rich" nations and also depends on whether one is bucking government planning in the United States, Great Britain, or India. But the problem becomes especially severe when a government's greatest fear is that some industrialists may become rich, which seems to be the case in India and possibly also in Great Britain. Although the United States government adds many controls, it fortunately does not lose sight of the fact that larger personal and corporate profits are the golden eggs that produce a larger GNP, increased taxable income, and a higher standard of living.

I have attended a week-long conference on problems of undeveloped countries where "profit," "industrial competition," and "free enterprise" were forgotten phrases and nearly every analysis ended with demands for more doling of outside aid. Analyses that disregard the human drives that produced the industrial revolution are not likely to point the way to any better solutions. While more R&D and technology are needed, they must bear fruit within human organizations. As an example, because of the absence of individual motivation, even though the Soviet Union stands in the front lines of science and technology it still cannot comfortably produce foodstuff or other commodities in proportion to her need or great technological capacity.

Let's continue to help each other and to extol the virtues of R&D and of technological information; but let's not disregard the human factors that are needed to turn these into a larger GNP. Let the governments of the "poor" countries reduce their bureaucratic "planning" by which nearly everyone remains poor, and instead address their attention to helping many thousands more to become "rich," taxably rich, through production of goods and through competition that depends on invention and innovation rather than on preferred position with the government.

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