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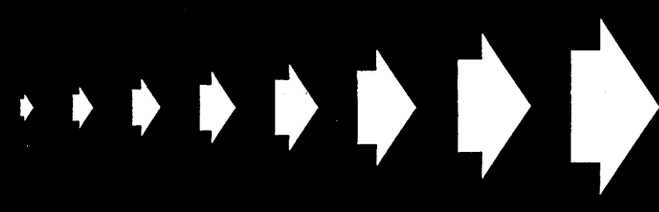

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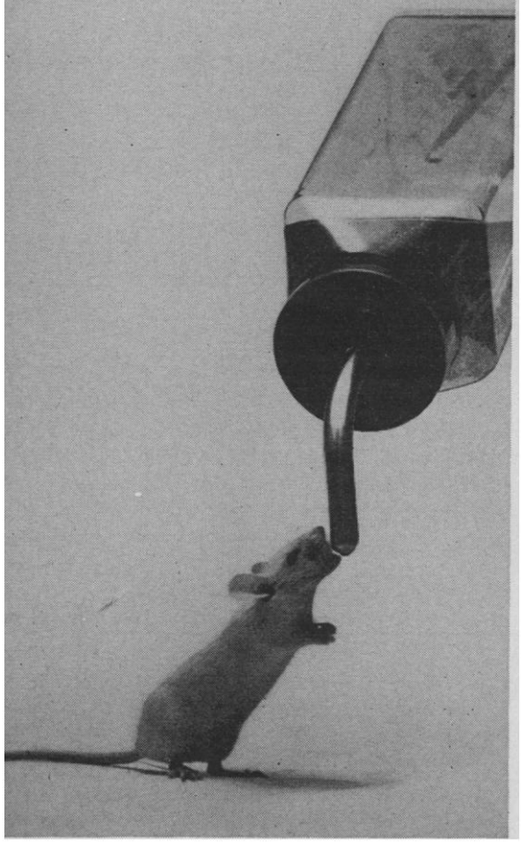

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LETTERS

Biomedical Engineering

In his article on biomedical engineering (19 Nov. 1971, p. 779), Leon Kass provides an optimistic view of the technological developments lying ahead, coupled with a thoughtful analysis of the problems involved in the manipulation of human bodies and minds through direct intervention. Of particular interest was his discussion of the social costs incurred in the application of these techniques to achieve potentially available benefits. This kind of tradeoff is pertinent to the application of many of today's technologies.

Unfortunately, a note of confusion might have been introduced by his use of the term "human engineering" as synonymous with "biomedical engineering." Although sometimes used in that sense, that is, to connote changes induced in people through biomedical techniques, "human engineering" is more widely used in almost the exactly opposite sense, namely, to refer to the design of equipment and machines in a manner that considers the behavioral characteristics of the people who must use them. In this latter connotation, the emphasis is on changing the environment to fit the human, rather than vice versa. There may be social costs as well as benefits involved in the latter approach, but they are undoubtedly a different set.

MARTIN A. TOLCOTT
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Kass's true stance on the new biology is perhaps best shown in his reference 11 which deals with the possible value of genetically increased intelligence. He says, "Given the activities in which many, if not most, of our best minds are now engaged, we should not simply rejoice in the prospect of enhancing IQ. On what would this increased intelligence operate? At best, the programming of further increases in IQ. It would design and operate techniques for prolonging life, for engineering reproduction, for delivering gratifications. With no gain in wisdom, our gain in intelligence can only enhance the rate of our dehumanization."

Many will disagree with Kass's narrow concept of intelligence and of its role in civilization. Scarcely a week passes when I do not observe my academic colleagues advocating foolish activities because they have narrowed a problem to the range of their understanding.

To the extent that I am privy to the worlds of industry, politics, and the military, I find that the evil done by the Establishment stems overwhelmingly from the stupidity of "men of goodwill" rather than from clever selfishness. By stupidity I mean inability to perceive abstract relationships and specific instances. What Kass sees as lack of an undefined "wisdom," I see merely as limited Stanford-Binet intelligence coupled with a narrow education. The humility and caution which Kass rightly advocates follow naturally from an understanding of the complexity of man's estate.

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In his stimulating article on the possibilities of the new biology, Kass quotes C. S. Lewis as writing that, "if any one age really attains, by eugenics and scientific education, the power to make its descendants what it pleases, all men who live after it . . . are weaker. . . . In every victory [over Nature], besides being the general who triumphs, he [man] is also the prisoner who follows the triumphal car."

There is nothing new in the idea that every age is the custodian of its heritage and that, as of today, any future age can cripple or destroy the human experiment. What is erroneous in this quotation is the supposition that perfected techniques of eugenics and education will result in a narrowing of genetic options for those who come after. This need not happen. It is highly improbable that it would happen, even if we did not perceive it as a special pitfall to be avoided. If this quotation from C. S. Lewis were the measure of human courage, we would still be running on four feet.

B. A. CLARK
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Increased dehumanization, the "final erosion, of the idea of man as something splendid or divine, and its replacement with a view that sees man . . . as simply more raw material for manipulation and homogenization" and "Hence, our peculiar moral crisis" are rightfully stressed by Kass as the awe-inspiring consequences of modern biomedical technology. But is this

something new? Copernicus's discoveries must have had a much more shattering effect on his contemporaries. Was not castration, probably the oldest known biomedical technology, even more dehumanizing than slavery in a world deeply committed to fertility-oriented religion? There has always been a "morality gap." "We could justly accuse the whole human race, since we became human, of a morality gap; and this gap has been growing wider as technology has been making cumulative progress while morality has been stagnating" (*1*).

What is to be done? Plato, in presenting a history of Socrates' life, quotes his teacher as saying: "When I was young, I was interested in the current fashionable philosophy, which was physical science, physics and astronomy, and geology. I came to realize that the important thing in the universe is human beings, not non-human nature, not the movements of the stars and not the nature of the chemical elements. What is important is the human spirit, so I decided that I would turn away from the study of non-human nature and would study why it is that men know what is good, but do what is bad." Toynbee (*1*) calls this a turning point in Greek morality. This same search has to become the turning point of our times. But by new institutions only? By properly educated people who are wiser and more clever? This is only a small and unsatisfying part of the total answer. It is more important, if not essential, to revise the orientation of mankind and the definition of man's location in the universe and his fate—individually and as a race. This orientation has to be religious in nature. Science, since the age of enlightenment, has been dedicated to, or fond of, atheism. Science, despite its secular traditions, should accept religion as a prerequisite for survival. Teilhard de Jardin presented a model for the possible marriage of modern science and the religious craving that is inherent in man. The fact that Albert Einstein was a deeply religious man, convinced of the existence of God (*2*), only shows that the torchbearers of scientific progress might also be the new saints, giving guidance to the essence of all great religions; egocentricity, man's fundamental problem and the cause of the morality gap of yesterday, today, and tomorrow, can be conquered by surrendering to spiritual, nonpossessive love, a task which philosophies only rarely and pseudo-religions, like Leninism and Maoism, never have achieved. Individual awareness of man's dignity in this religious sense, acceptance of the individual's responsibility toward mankind, and education devoid of short-sightedness and close-mindedness toward tolerance and mental stability, seem to hold the key to at least partial avoidance of "the accidents of our hasty, biased, ephemeral judgments." Let us never cease hoping that enough time is granted to reach these goals before it is too late for the victims of those hasty, biased, and ephemeral judgments.

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Chest X-rays

Science is to be commended for its attention (see News and Comment, 10 Dec. 1971, p. 1114) to the ineffectual use of mass chest x-ray screening programs which result in unnecessary and avoidable x-ray exposure to the general population. In this connection, the U.S. Public Health Service, in cooperation with the American College of Radiology and the American College of Chest Physicians, issued a policy statement on 18 February 1972 that recommended discontinuance of the use of the chest x-ray screening procedure for detecting cardiopulmonary disease.

The Bureau of Radiological Health of the Food and Drug Administration, Department of Health, Education, and Welfare, took the lead in developing the policy as a part of its continuing efforts over many years to reduce unnecessary and unproductive radiation of the public from all sources. In particular, the statement on chest x-ray screening policy resulted from activities which the bureau initiated over 3 years ago, evolving through consultations with interested individuals and groups in addition to the two groups which co-sponsored issuance of the statement. This fact should be reassuring to those readers of *Science* who were not aware of our efforts.

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Research and Planning

We are all familiar with Bertrand Russell's famous nonquestion, "Who shaves the barber?" The barber's quandary, it will be recalled, stemmed from the fact that in his community he shaved every man who did not shave himself and he shaved no man who shaved himself. I have referred to this as a nonquestion because, although at first blush it looks like a question and parses as a question, the attached definition of the barber's domain precludes a proper answer. In our family we have an in-joke that ends, "Ask a silly question and you get a silly answer." I should like now to suggest that, if you ask a nonquestion, you get a nonanswer.

Nonquestions may be more common than is generally supposed. We in science and science administration are frequently asked, "How do you plan research?" Albert Szent-Györgyi,* drawing on his long and fruitful career, has written: ". . . research means going out into the unknown with the hope of finding something new to bring home. If you know in advance what you are going to do, or even to find there, then it is not research at all: then it is only a kind of honorable occupation."

And again: ". . . when I go home in the late afternoon from my laboratory I usually do not know what I am going to do the next day. That depends on what I found today, and I need time to digest it, which I mostly do overnight."

Research is the invasion of the unknown. One may traverse previously mapped territory, planning one's course in some detail until one reaches the border of terra incognita. At this boundary, there must be an abrupt change in strategy. The jungle is dense, perception is limited. One cannot know where one will be a day hence, one cannot be certain of either distance to be covered or direction to be taken. In short, one cannot plan.

The best one can do is prepare for contingencies. Supplies and navigational tools may be acquired and survival skills may be learned—but these may never be needed, while others, soon to be needed, may be overlooked. As one trudges through the jungle, foresight is generally limited except when an occasional clearing is encountered. Once the trail has been blazed, to pave it into a road can be a planned operation; but, as Szent-Györgyi points out, this is no longer research.

If research is equated with a form of intellectual endeavor that cannot be planned, then the question, "How do you plan research?" translates into, "How do you plan that which cannot be planned?" This is clearly a nonquestion. If a resolution is needed it may be sought in the realm of trans-science,† where unanswerable but superficially scientific questions find operational solutions in the legal and legislative techniques of adversary confrontation, advocacy, and the polling place. Preparations for the conduct of research (for example, funding and training) may be planned, but the research proper remains an unplanned exercise.

—DEWITT STETTEN, JR., *Director, National Institute of General Medical Sciences, Bethesda, Maryland 20014*

* A. Szent-Györgyi, *Perspect. Biol. Med.* **15**, 1 (1971). † A. M. Weinberg, *Minerva* **10**, 209 (1972).

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