advance increases the power, freedom, or wealth of one group at the expense of others. My own view is that the principal effect of the scientific revolution, especially in the 20th century, has been to change the nature of the social and economic game from a zero-sum one to a situation where many can benefit without cost to others. We are gradually moving from an economy of scarcity, inevitably based on exploitation of the many by the few, to a society of abundance, in which for the most part the exploitation of one group by another does not pay, even for the exploiter.

There is little evidence to support the proposition that inequalities are growing in the modern world, either within the developed nations, or between developed and underdeveloped regions. In the words of Carl Kaysen (*1*), "Economic history shows that, after the early stages of urbanization and the development of commerce, economic growth has tended to greater equality of incomes, both within nations and between them." In the United States, relative income distribution, after some equalization during World War II, has remained stable with a slightly equalizing tendency, and this has apparently been true in most industrial countries, including the Soviet Union. The relative income gap between the developed and underdeveloped countries has been closing slightly, although this is often disputed. It is true that absolute gaps have been increasing as the world economy grows, and this has frequently enhanced the perception of deprivation, especially under the impact of modern communications and personal mobility.

Most fundamental knowledge has been neutral with respect to the distribution of power and wealth. Certainly it has helped to bring wealth and power to some who started from a position of little power, and acquired it through exploitation of fundamental knowledge for the fulfillment of some human need or demand. Such a development cannot really be characterized as either equalizing or nonequalizing in its net social effect. In general, during the last two generations, the advance of knowledge has enabled many people to advance from working-class status to professional and technical occupations which offer greater freedom and self-fulfillment. In the last 25 years, the number of such careers has increased three times as fast as the total number of jobs of all kinds. Yet it is difficult to describe such a social change in terms of equality or inequality. Even for the hourly worker, the 40-hour week has surely increased options, as has the disappearance of diseases such as diphtheria, smallpox, and polio or the decline of diseases such as tuberculosis, malaria, and pellagra. Perhaps Lewontin regards these examples as "trivial" or as inapplicable because they have not punished the rich and powerful, even though they have improved the lot of most people.

The impact of modern communications illustrates the difficulty of meaningfully discussing the impact of modern science in terms of equalizing or amplifying differences in power. On the one hand, communications and air transportation have played an important part in raising the political consciousness of disenfranchised groups in developed societies and in raising the aspirations of the underdeveloped countries, as well as their actual influence in worldwide deliberative bodies such as the United Nations. It is quite true that all over the world sights have been raised much faster than actual improvement in the conditions of life, thus creating frustration and a perception of decline in power of the powerless. Improvements in the lot of the poor have fallen shorter of expectations than in the past, not because these improvements have been trivial, but because the expectations have been much higher, largely as a result of the vistas opened by the freer circulation of knowledge in the world.

Furthermore, the telephone, television, and cheap copying have made it possible for underprivileged groups to organize politically (or be organized by others), and to make their expectations and demands heard in the national and international political arena for the first time. During the past dozen years minority groups in the United States have made more political and economic progress relative to the general population than at any time in American history, as has been amply documented by studies of family income, health, job access, and other indicators. It is painfully true that poverty is still with us, and seems more intolerable than ever in the past, precisely because we now know that modern science makes it unnecessary. But should we blame modern social science for creating and perpetuating inequalities and injustice in our society, or should we praise it for documenting them and making them incontrovertibly visible for all to see?

In reply to Plaut's letter, I think the difference between us is largely semantic. I would have classified the Nazi revolution as a counterrevolution, basically atavistic and reactionary from a cultural viewpoint. Hence I was not thinking of the Nazis in my generalization.

However, even if one were to accept Nazism as revolutionary, I would argue that it leaned heavily on the authority of science to acquire credibility in the eyes of its constituency and the German intellectual community. That the science appealed to was a distorted and discredited pseudoscience from the 19th century does not alter the fact that the regime found it advantageous to don the mantle of scientific authority to justify even its worst crimes. Mass murder was raised to a high point of technological efficiency, and the murderers prided themselves on the fact that it was all done very scientifically.

It is true that the Nazis attacked modern physics and largely dismantled the great German scholarly enterprise. But these attacks were not so much on science as such, as they were an effort to discredit authentic science in order to set in its place the pseudoscience required to justify the regime. The fact remains that the Nazi revolution purported to be based on science and did not attack the scientific method of knowing as such, unlike the situation with the modern counterculture.

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DDT Toxicology

Samuel S. Epstein, testifying before the Environmental Protection Agency on behalf of the Environmental Defense Fund (Point of View, 11 Feb., p. 610), makes a seemingly all-inclusive denunciation of "The current practice of toxicology," describing it as "an excessively insensitive and crude procedure." He states, without making exceptions, that "Animal test systems, quite apart from being grossly insensitive as a function of sample size, are hopelessly artificial in their design." But, on the basis of animal experiments, he states positively that, in his opinion, man cannot be

safely exposed to any levels of DDT and that "DDT has been shown to be carcinogenic."

Epstein has ignored the fact that not a single case of human cancer due to DDT has been proved anywhere in the world in the quarter of a century in which hundreds of millions of humans have been exposed to DDT. Even among employees of a DDT plant, 11 to 19 years of heavy exposure to DDT has caused no demonstrable illness, and definitely no cancers. Let some qualified statistician, balancing this record against a few "crude" and "grossly insensitive" animal experiments, determine the odds that someone, somewhere, sometime, may have a cancer due to DDT.

"Science" is defined as "Knowledge; especially knowledge gained through experience" (*1*). I am forced to conclude that Epstein's "point of view" is not science. Rather, it is anxiety-produced and -producing propaganda for the Washington lobby of the Environmental Defense Fund. The use of DDT has its problems. The World Health Organization and many governmental and private agencies throughout the world are conducting research to find a substitute that will be more actively biodegradable, but equally effective, cheap, and safe.

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The insensitivity of current toxicological practice stems largely from statistical considerations that reflect the very restricted number of animals conventionally tested for adverse effects induced by a chemical, including carcinogenicity, mutagenicity, and teratogenicity, when millions of humans are at presumptive risk (*1*). In spite of such insensitivity, DDT has been shown to be carcinogenic in various tests and in various species, and its continued use clearly poses potential carcinogenic hazards to man. It must be stressed that the experimental determination of carcinogenicity is a relatively uncommon occurrence; in the Bionetics carcinogenicity study of over 140 pesticides and other industrial chemicals, less than 10 percent were shown to be carcinogenic in mice, even when tested at the largest tolerated doses, with exposure commencing in infancy (*2*).

It is very difficult to demonstrate carcinogenic and other adverse effects of chemicals which are widely disseminated in the environment and for which sharp differentials in exposure cannot be established between large populations followed up for long periods of time. It is largely because of these difficulties that no valid epidemiological data on the carcinogenicity of DDT are available.

I freely admit to anxiety about the widespread dissemination of carcinogenic chemicals, especially when there is no evidence that they are more effective or more critically needed than other, noncarcinogenic agents. This has not been established for DDT as it is used in the United States.

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Organic Chemists and Odors

In most theories of olfaction, it is assumed that "acceptor sites" exist on the excitable portion of receptor cell membranes, where odorous molecules bind during excitation. Such theories usually state that the mechanism of odorant-acceptor attachment does not depend on simple chemical attributes of the odorant, but that it involves more subtle chemical parameters, such as molecular vibrational frequency or stereochemistry. However, experienced organic chemists often seem to be able to name unknowns by chemical class, functional groups, or certain heteroatoms. We would like to attempt to quantify this supposed ability by testing a large number of organic chemists with a series of selected odorants. Organic chemists who think they have a good nose for unknowns and who have an hour of their time to spare can write to us to receive a free, disposable testing kit. Each participant will receive a full report of the study after its completion.

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