

Letters

Waste Heat Management

Hetrick and Seale, in their letter (26 Jan.), appear puzzled by the fact that waste heat presents a problem for nuclear power plants but not for fossil-fueled plants. Fossil-fueled plants, while not immune from the second law of thermodynamics, currently operate on a more efficient thermodynamic cycle and therefore reject less waste heat for each kilowatt-hour of electrical energy produced, about 6000 BTU versus 8500 BTU for nuclear plants. Furthermore, in order to effect economical operation, nuclear power plants tend to be several times larger in electrical power output, and this aggravates the problem of waste heat management.

The writers present the choice for the future as between "thermal pollution" and a shortage of electric power. I believe that we have a variety of technical means at hand to get rid of the waste heat, and that imaginative constructive uses of the waste heat are also possible: climate control, desalting of water, heating buildings, heating irrigation water, aquaculture, and so forth. Thus, the real choice is between thermal pollution, when the waste heat is simply dumped into a river or estuary, as against paying a surcharge of under 5 percent, or much lower—depending on ingenuity—for restoring the water to its original temperature state.

As the need for electric power increases, the problem of waste heat management will become a major one. To give an idea of the dimension of the problem, by 1985 about one-quarter of the total run-off of the United States will be used for the cooling of electric power plants. We might as well face up to the problem now and solve it while it is still manageable, and avoid serious ecological consequences.

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Heredity and Environment

It is not my purpose to debate with either Shockley or the National Academy of Sciences on the desirability of increasing research on the relative significance of heredity and environment on human performance ("Racial studies: Academy states position on call for new research," 17 Nov., p. 892). Rather I would emphasize that mankind can be studied without getting into loaded questions which can be destructively exploited by racists. Let us start with the assumption that "states of health or disease are the expressions of the success or failure experienced by the organism in its efforts to respond adaptively to environmental challenges" (1, p. xvii). Let us also include in the concept of diseases those forms of social pathology or deviation that tend to cause genetic deaths in adolescent or post-adolescent humans (homophilia, hard narcotics addiction, and compulsive criminal behavior are examples). Biological models based on diseases where host and pathogen show marked mutual adaptation tend to demonstrate that the relative contribution of heredity and environment is a meaningless question, and I rather suspect that most adaptation failure syndromes will turn out to be comparable. One expects surviving populations to produce genetically inferior individuals as a result of genetic recombination, but their presence is no evidence that the population generating them is inferior. In fact, it is generally also meaningless to apply researcher value judgments to surviving populations, races, or cultures, a principle that anthropologists seem to know well. In the proper study of human adaptation there are two classes of observer position which must be kept reconciled; one class deals with individuals and the other with populations. The easiest way to distinguish the two positions is to borrow Lawrence Slobodkin's quasi-teleological idea that evolu-

tionary processes are analogous to a game.

One observer is interested in seeing how far the game analogy can be pushed. Further, he is interested, for example, in new formulations of the genetic load hypothesis and in vigorously testing with animal models such hypotheses as the Sacher-Trucco theory of mortality, and Slobodkin's idea that there is an evolutionary advantage in having a relatively larger number of less healthy animals than having a smaller number of more healthy ones. His measures are in terms of morbidities, mortalities, genetic deaths and near deaths, and population physiology, and they allow no room for measures of good and bad.

The other observer is trying to bias the game in favor of a good outcome. This is the traditional position of the physician, the social worker, and the teacher. There is a hierarchy of goods of which generally the most important is that of the individual who is the object of the professional attention. Good and bad heredity and environments only have meaning insofar as the individual concerned and his advisers perceive them to be such.

Behind all this the fundamental question really is, can man participate intelligently in his own evolution without destroying the truly humane values in society? The answer is an unqualified yes if it turns out that both classical and social pathology are to a large degree the results of evolutionary pressures. But we probably will never know since obviously "the intellectual atmosphere in the scientific establishment is becoming increasingly incompatible with the study of biomedical problems that involve more complex living systems" (1, p. 445).

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Reference

1. R. J. Dubos, *Man Adapting* (Yale Univ. Press, New Haven, Conn., 1965).

Copper Deposit at Glacier Peak

Whether or not the copper deposit in the wilderness near Glacier Peak should be mined is a question which should be judged by attempting to weigh the very different values involved,