LETTERS

Recombinant DNA Research: International Cooperation

The World Health Organization (WHO) carries a major responsibility to protect the health of mankind. This is a social responsibility that must be fulfilled, not only in securing the benefits derivable from basic and applied biomedical sciences, but also in coordinating those measures aimed at the reduction of the risks associated with the natural environment of man as well as his multiform activities.

It is thus appropriate that WHO has given and gives great attention to the problem of research in genetic manipulation and, in particular, to recombinant DNA technology. In 1975 the WHO Advisory Committee on Medical Research recommended to the Director-General that "the continuation, under appropriate safeguards, of microbiological research, including genetic manipulation and cell fusion studies, is of the utmost importance for progress in medicine and public health." Accordingly, a Special Programme on Safety Measures in Microbiology has been set up within WHO. Among other items, its objectives include a close review of this research activity. Specifically, WHO can serve as an international focus for the collection and dissemination of information, so that appropriate initiatives can be considered at the national and international levels. WHO can also see that the various initiatives are coordinated, especially for the development of the safest possible biomaterials and the evolution of techniques which reduce the hazards of working with them.

Clearly, a most crucial parameter in deciding the best avenues to these ends is the assessment of the so-called "conjectural" or "potential" risks associated with recombinant DNA research. The evaluation of their specific nature and level, as quantitatively as possible, can create formidable limits both to the design of experiments and to the interpretation of the ensuing results. Nevertheless, careful risk assessment is a necessary prerequisite to reconciling the different, and often conflicting, scientific views on this subject.

The WHO special programme is intended to stimulate all concerned and competent scientists (i) to cooperate in the design of appropriate experiments for the acquisition of relevant data on risk assessment; (ii) to see that the most meaningful experiments are performed as

safely as possible and without delay; and (iii) to ensure wide participation in the analysis of the results, be they positive or negative. To this end a letter has been circulated to more than 200 involved scientists, and their answers are being analyzed.

But any exercise in the assessment of risks must include an equally careful analysis of the expected benefits. It is therefore of the utmost importance that recombinant DNA research be developed with close consideration not only to its contributions to the fundamental problems in molecular genetics but also to the conversion of their solutions into practical and beneficial applications. Explicit action toward these goals should go beyond conferences and courses to collaborative research. Results of experiments will be required to ensure that the claims of proponents of a lively continuation of research in genetic manipulation are legitimate.

Once the risks are more critically assessed, and the benefits more clearly defined, appropriate steps ought to be taken by the various national and international bodies concerned. These initiatives should lead to an improved concept of international cooperation toward safer and more productive research in this as well as other areas of biomedical science.

V. SGARAMELLA
Consultant, World Health Organization Special Programme on Safety Measures in Microbiology, Consiglio Nazionale delle Richerche, Pavia, Italy

Is Sweden More Energy-Efficient?

In their article "Efficient energy use and well-being: The Swedish example" (3 Dec. 1976, p. 1001), Schipper and Lichtenberg draw the conclusion that Sweden is more energy-efficient than the United States by comparing the economic output per unit of energy consumption in the two countries. They further conclude that the living standards are the same in each country. Although the study is an interesting analysis, these conclusions are a misinterpretation of the facts. Based on the simplistic criterion used in the analysis, the states of New York, Rhode Island, Vermont, Connecticut, and Hawaii are more efficient in economic productivity per unit of energy use than is Sweden. Although such studies as that of Schipper and Lichtenberg are beneficially provocative in the energy conservation debate, they may also become exhortations for unrealistic energy conservation targets.

A basic fallacy in their study is the omission of the difference in the mix of industrial, service, and agricultural activities within the two countries. An analysis of different economic activities in the United States reveals that energy use per unit of labor varies by as much as a factor of about 75 between energy-intensive operations, such as oil refineries, to such low-energy users as printing and publishing. For example, the United States refines 133 percent more oil per capita than Sweden: but Sweden produces 77 percent more newspapers and 141 percent more books per capita than the United States. Because of the differing industrial mixes among the states of the United States, there is a variation of about a factor of 5 in the economic output per unit of energy among the 50 states—even though the United States has a mobile labor market, a common economic basis, a common currency system, and common consumer product availabilities and life-style. Similarly, variations in the detailed industry mix in each nation can result in large variations in the energy used per unit of economic output and can be misinterpreted as differences in technical efficiency of energy use and in implementation of conservation.

Schipper and Lichtenberg mask the true comparison of the economic value added in manufacturing per unit of energy use as shown in their table 9 [column E_J (kwh/$)]. Manufacturing use of electricity is certainly separable from the available mix of generation sources, and this comparison should have been made on equivalent primary energy input (the gross kilowatt-hours total described in the heading of table 9). If this table is thus recalculated, then the kilowatt-hours of total energy (t) per dollar of value added would show the United States at 16.5 kwht per dollar and Sweden at 21.2 kwht per dollar. Thus, Sweden's manufacturing is only 78 percent as economically effective in the use of energy as is U.S. manufacturing. This should not be interpreted as indicating either Swedish wastefulness or a potential for conservation—rather it is undoubtedly the result of the economic optimization of the use of all the resources (capital, labor, materials) available in each country.

Further, international comparisons, as between Sweden and the United States, are distorted by the difficulty of converting monetary exchange rates into comparisons of real purchasing values. The comparison of the well-being or scale of living among nations cannot be inferred by the dollar equivalent of monetary exchanges. Total personal income per family is a better measure of economic well-