13 September 1963, Volume 141, Number 3585 **SCIENCE**

Responsible Scientific Choice

The scientific community has not responded adequately to the high trust placed in it by the nation. Perhaps if our role were better understood we would search more diligently for ways of discharging our responsibilities. For more than a decade science has been the recipient of repeated congressional votes of confidence as funds for research and development increased from $1.6 billion in 1950 to $14 billion in 1962 (including space). Most of the federal budget goes for fixed purposes, such as interest on the debt, veterans' benefits, salaries of military and civilian personnel, military hardware, and general government housekeeping. The funds for research and development represent a major fraction of the nation's capacity to achieve progress in defense technology, science, and the general welfare.

Most of the funds go for developmental work, including hardware which will be obsolete in a few years. The nation's hopes for substantial long-term progress lie in fundamental research and in a few areas of basic development which receive but a minor fraction of the total amount spent. It is of crucial importance that the best possible judgment be shown in the allocation of funds, and especially of manpower, in these areas. Our present methods do not meet the challenge of the needs.

Government agencies attempt to tap the best minds by appointing advisory panels of experts. Usually these experts are from one limited relevant field. This narrow intellectual base creates an atmosphere which heightens provincial attitudes. Such panels seem only to be able to conclude that their field needs more men and more money.

The basis for a new and sounder approach has been outlined by Alvin M. Weinberg in the 1963 Winter issue of *Minerva*. He points out that criteria for scientific choice can be established. Two of these criteria are internal: "(1) Is the field ready for exploitation? (2) Are the scientists in the field really competent?" But Weinberg considers a group of three external criteria to be more important: "technological merit, scientific merit and social merit. The first is fairly obvious: once we have decided, one way or another, that a certain technological end is worthwhile, we must support the scientific research necessary to achieve that end."

One of Weinberg's arguments on scientific merit is particularly apt: "other things being equal, *that field has the most scientific merit which contributes most heavily to and illuminates most brightly its neighboring scientific disciplines.*"

On the basis of these criteria, it is possible to estimate the comparative value of such divergent fields as molecular biology and high-energy physics. This is done in the *Minerva* article with convincing clarity, and high-energy physics comes off badly.

Weinberg suggests that our present system could be improved if representatives not only of the field being judged, but also of neighboring fields sat on panels that are assessing the merits of research proposals. This suggestion should be implemented. It also should be possible to set up a point system, in which various weights are given to the components of internal and external criteria. Weinberg has initiated a very useful line of reasoning, and further thinking along these lines is in order.—P.H.A.

(Reprints of Dr. Weinberg's article, "Criteria for scientific choice," may be obtained from Dr. Alvin M. Weinberg, Director, Oak Ridge National Laboratory, Oak Ridge, Tenn.)