1 January 1982, Volume 215, Number 4528 **SCIENCE**

Luck, Merit, and Peer Review

Every year the National Science Foundation spends a billion dollars, mostly on the support of research. A recent report commissioned by the foundation* suggests that chance enters significantly into decisions of the peer review system by which NSF evaluates funding requests for scientific research. The report indicates that about 25 percent of NSF decisions would be reversed by a different panel.

"Capital punishment," or loss of grant support, is cruel, but no longer unusual, in academia. The notion that chance enters into the decision-making process adds a special twist, and this study has raised calls from many quarters for elimination of the peer review system—a reaction not at all justified by the findings. Distribution of research funds in block grants to states or by random lottery, both of which have been suggested, would foster mediocre research.

We have become chary. We insist on certainty whether or not it is practical. We want zero levels for pollution, accountability of school teachers for what our children learn, and guarantees that the products we buy will not break, wear out, or cause injury. If disappointed, we sue for damages.

But honest scientific research is a gamble. The peer review system is probably the best method the NSF has for placing its chips. Every time a bet is placed, something is risked. We might reduce the uncertainty considerably by doubling the number of readers for each proposal. Would this be worthwhile?

In the peer review system, a proposal is evaluated independently by "peers" chosen from a pool of reviewers qualified in the area of the proposal. In most areas, only proposals rated "excellent" or "very good" have been funded in recent years. Budgetary constraints undoubtedly prevent the funding of many worthwhile proposals.

Since research proposals are by their very nature speculative, it would be dishonest to propose funding for research already completed. Therefore it is not surprising that reviewers disagree substantially on the value of proposed research, the ability of the scientist, and the level of funding required.

How likely is it that one panel of five will disagree with another?

Suppose there are 20 qualified reviewers for a proposal, all of whom give an opinion. If 13 of them are in favor of the proposal and seven are against it, the majority opinion will carry and the proposal will be funded. If, however, five reviewers are chosen at random from the 20, slightly more than 20 percent of the proposals they evaluate will not be funded. If only 12 of the 20 eligible reviewers favored the proposals, 30 percent of the time a "wrong" result would occur. In the three fields considered by the report, between 24 and 30 percent of the decisions would have been reversed by a different panel.

The report itself concludes: ". . . our research both in this and in other studies in the sociology of science indicates that concerning work currently in process there is substantial disagreement in all scientific fields."

In this situation there is less than meets the eye. It is not in the least amazing that opinion varies in every scientific field on the most promising avenues for investigation. Nor is it surprising that differences surface in the evaluation of proposals which are, at best, an impermanent and imperfect reflection of the scientist's thoughts about the logical next step.

Despite our best efforts to reduce the inherent unfairness of life and to minimize errors, some risks and some faults will remain. We want to spend our tax dollars wisely. The nation needs scientific research, but we cannot buy it by the yard and return the unused portion to get our money back. We cannot know for sure what research will pay off. We must accept the fact that uncertainty is inherent in the system.—ALLAN H. CLARK, *Dean, School of Science, Purdue University, West Lafayette, Indiana 47907*

*J. R. Cole and S. Cole, with the Committee on Science and Public Policy, *Peer Review in the National Science Foundation: Phase Two of a Study* (National Academy of Sciences, Washington, D.C., 1981).