forging the blade at a low temperature. In April 1822, a sword forged from Bréant's steel by a Parisian cutler named Cardheilhac was displayed at a meeting of the Société d'Encouragement pour l'Industrie Nationale (*4*). Bréant's paper (*3*) was briefly withheld from publication for reasons of national security, but it eventually appeared in the *Bulletin* of the society. At least four English translations were published within the next 2 years. Bréant's work had many imitators, including the Russian Anossov, whose extensive but rather unimaginative work in turn inspired the critically important scientific studies of D. K. Tschernoff (Chernov) beginning in 1868. Another Russian, N. T. Belaiew, in 1914 pointed out (*5*) how important the study of the blades had been to the development of modern metallography. Far from being rediscovered in the 1980's, the "secret" of Damascus steel was well known in the 19th century. Its study was central to the development of understanding of the relation between the structure, properties, and treatment of complex materials and thus is a very real part of the prehistory of modern solid-state physics.

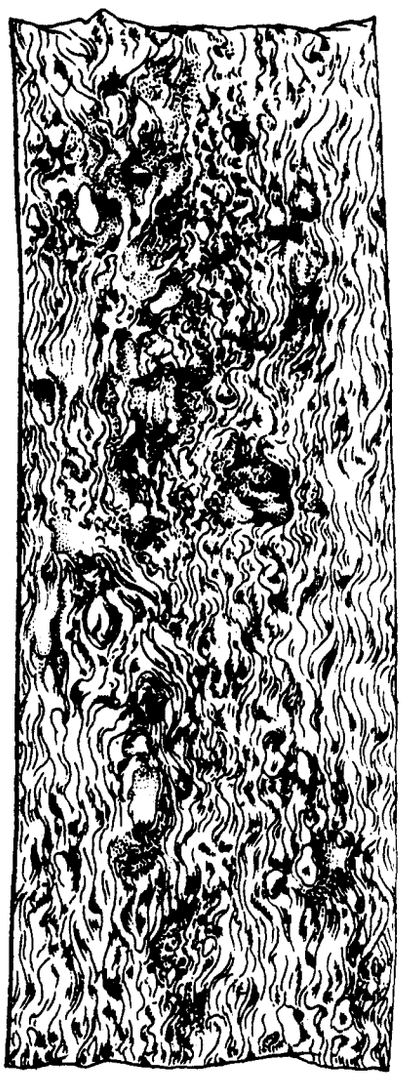

Fig. 1. Engraving showing the texture of a Damascus sword blade forged in 1821 from an ingot of crystallized steel made by J. R. Bréant in duplication of the true Oriental technique. [From (*3*)]

The duplex structure of true Damascus steel originated in the coarse crystallization of the cake of *wootz*. Some swords and all Damascus-textured gun barrels were made by a quite different technique, that of joining together by hammer-welding strips of steel of different composition, and folding, twisting, or otherwise deforming the mass to get the desired texture. Many blacksmiths are doing this in the United States today with appealing results. A few are working with the far more difficult crystallization process.

The history is treated at length in two of my publications (*6*) and most recently and comprehensively in a book by Jerzy Piaskowski (*7*).

CYRIL STANLEY SMITH
Massachusetts Institute of Technology, Cambridge 02139

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Effective Funding

In his editorial on peer review (1 Jan., p. 11), Allan H. Clark makes some serious overstatements in defense of the peer review system. Citing a recent study (*1*) which points out that chance enters significantly into decisions by the peer review system, he takes the position that, since uncertainty is inherent in any system, we must hold fast to peer review as it is presently used.

He asserts that the recognition of the chanciness aspect has "raised calls from many quarters for elimination of the peer review system"; may we ask who it was that called for such elimination? In the recent past eight articles and editorials have been published in *Science* (*2*) and five in *BioScience* (*3*) that have criticized the peer review system, and not one of them has suggested that peer review be dumped. Instead, they have suggested either setting up a part of the granting system in another mode or making modifications such as the use of signed reviews or of rebuttals by the investigator.

He asserts that "block grants . . . would foster mediocre research." Yet his own institution, Purdue University, became one of the most distinguished centers of plant physiology, plant pathology, animal physiology, and biochemistry in the 1950's and 1960's largely through block funding of the Agricultural Experiment Station.

He asserts that if 13 out of 20 reviewers are in favor of a given proposal, "the majority opinion will carry and the proposal will be funded." Anyone who has served on a peer review panel knows that this is not realistic. If one reviewer is strongly opposed to a proposal, it will often be rejected; if more than one is strongly opposed it almost certainly will be rejected, and the divisions of the National Science Foundation have established oversight committees with the particular intent to challenge program directors who recommend funding for proposals that have been given any serious objections.

There are many in the science community who feel that exclusive dependence on peer review for funding decisions is not only expensive in time but serves to favor reductionist proposals and proposals in popular or fad subject areas and tends to provide bias against more daring or innovative proposals. In short, peer reviews tend to strengthen authoritarian conservatism. Surely the history of block grant funding, such as in the agricultural experiment stations and in the Office of Naval Research, has yielded vivid proof that the peer review system is not the only way to provide for effective research support.

A. C. LEOPOLD
Boyce Thompson Institute for Plant Research, Cornell University, Ithaca, New York 14853

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