

door to discussion within APS of any issue under the sun, a discussion that would be hopelessly divided between the merits of the particular issue and the appropriateness of the issue as a matter of concern to APS.

Speaking of the substance of the amendment, I would be in favor of a change that would allow a discussion within APS of issues directly pertaining to the work of its members as scientists. Such issues would include topics like scientific priorities, scientific aspects of foreign aid, the impact and the connection of science with governmental agencies such as the Department of Commerce, Department of State, Department of Housing, etc., the allocation of national resources for scientific research, the social structure of scientists themselves, and many others. I feel that these are issues that at least partially match the special competence

we are supposed to have; therefore their consideration would be a significant contribution to ourselves and to society as a whole.

I would be very much opposed to allowing APS to discuss general public issues. Each of us, as an individual, has innumerable outlets for such activity, including some organizations especially geared to scientists. Dragging APS into this would be quite superfluous. In addition, I am also very sensitive to any trend that might result in public statements by APS on issues in which we have no special competence. Such statements would necessarily carry in the public mind a false tinge of importance and authenticity just because they are utterances by scientists who, according to the contemporary myth, have at least the key to the solution of all problems by their "objective," "scientific" method.

MICHAEL J. MORAVCSIK
University of Oregon

Subcritical and no joke

The "Search and Discovery" department in the September issue struck a jarring note with the comment, "With a little effort you can become the only kid on your block," using a "Smallest Nuclear Reactor." The essential point in the associated work was exactly the opposite. Presuming complete ignorance of criticality safety work, it is still impossible to make less than about 1 kg of U^{235} supercritical unless you work with water solutions in a large volume of a good moderator such as beryllium, graphite, or heavy water. Using much less than 1 kg, for example, the 242 grams quoted, you are completely safe from a nuclear transient in any geometry—and that is very nice to know. There has been such a great deal of nonsense connected with the possibility of a nuclear reactor exploding that I noted the editor's tacit agreement with much regret.

CARROLL B. MILLS
Los Alamos Scientific Laboratory

Environment and medicine

I would like to congratulate *PHYSICS TODAY* and Albert Crewe for the excellent article "Science and the War on . . ." (*PHYSICS TODAY*, October, page 25). It is encouraging to see a person

of Crewe's stature calling us to task. The complexities of the problem of uncluttering our environment are enormous and will require the concerted effort of all professionals, as professionals.

We at the American Medical Association are focusing in on the medical aspects of environmental pollutions and how the medical profession can attack the problem. Only by the combined efforts of professionals from various disciplines do we have a chance of cleaning up our environmental septic tank.

GORDON R. ENGBRETSON
Department of Environmental Health
American Medical Association

In support of applied research

Problems of the types described in Albert V. Crewe's article (*PHYSICS TODAY*, October, page 25) exist in an atmosphere of social, economic and political pressure. Such an atmosphere is not conducive to free investigation and, consequently, is shunned by scientists as investigators. The result is often a general disdain by scientists for applied research. Applied research is viewed as being subject to corporate and government pressure and tackled with shoddy thinking.



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Such a view of applied research is not necessarily accurate—even when it concerns problems outlined by Crewe.

The terms "applied" and "basic" appear to have become associated with "directed" and "undirected." The distinction lies in whether specific goals are to be attained within a definite time interval. In the extreme, directed research may have dictated in advance the tactical approach to a problem and the kind of results desired. Conversely, undirected research in the extreme may be totally devoid of long-range planning. Most research falls between these two extremes. This fact blunts the distinction between applied and basic research. The question, then, is how much applied research should be pursued. For example: Is applied research appropriate to either a master's thesis or a doctor's dissertation?

Applied research is not the easiest kind of research. Usually research must be completed within a specified time interval; consequently the plan of attack must be carefully considered. Applied problems involve usually more than one area and often more than one discipline. The results of such investigations and their significance must be communicated accurately and clearly to persons knowledgeable in the scientific and technical aspects of the problem. To be adequate to these demands the researcher must have intuitive foresight, breadth of outlook and depth of understanding. These attributes are the basis on which the skill of precise thinking can be developed. They are the same attributes we hope to see in our graduate students. From these considerations, applied research may furnish appropriate problems for graduate research in, for example, physics—or any of the natural sciences.

R. Hobart Ellis Jr's editorial in the same issue suggested very realistic economic motives for pursuing applied research. There are equally realistic educative motives for the judicious acceptance of applied research as appropriate to graduate programs in the natural sciences.

SCHWAB S. MAJOR JR
University of Missouri at Kansas City

Cutting NBS budget

The cut, by Congress, of the budget of the National Bureau of Standards (PHYSICS TODAY, August, page 51) accentuates the peril that has threatened this valuable institution for quite some time. Whether the present stress on mission orientation is justified or not, it appears reckless to sacrifice to it a service of such importance to the scientific community for a gain of just \$7.8 million (!).

Your story attributes this continuous misery to the lack of skill of NBS experts in expressing themselves to congressional committees. It appears to me that both Congress and the NBS dispose of plenty of witnesses, expert in science as well as communication, who could testify for the quality of men and topics sacrificed by this ruthless and petty decision.

NORBERT J. KREIDL
University of Missouri at Rolla

Baccalaureate Origins of PhD's in Physics

The "State and Society" section of the August PHYSICS TODAY published a report, "NAS Data Give Baccalaureate Origins of PhD's in Physics," stating that of all US students who earned PhD's in physics during 1958-66, 70% received their bachelor's degree from PhD-granting institutions, 19% from MS-granting institutions and 11% from four-year institutions. This report cites earlier data from M. Hugh Trytten, National Academy of Sciences, which indicate that in 1936-45 four-year colleges had been the origin of 35% of the 1160 physics PhD's. It continues with a discussion of "causes of decline," and concludes that four-year colleges now produce only about 11% of future physics doctorates.

Is there a decline in physics PhD's with baccalaureates from four-year or undergraduate colleges? Intelligent answers to questions related to the role and importance of various types of educational institutions require more than a superficial treatment. Analysis is not as simple as the PHYSICS TODAY report assumes. Several points should be considered: (1) It is not possible in principle to determine the present importance of various types of educational institutions, as baccalaureate



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