ing with Sakharov. That is precisely what I will not do. In the first place, during the few decades I have been a teacher and researcher in physics I have not come across a single paper in physics by Sakharov, nor a reference to it. He is supposed to have been a young and ambitious party loyalist when Stalin chose hin in key roles to get their H-bomb going. One doesn't have to know much physics for such roles. Secondly, even the American press has conceded that his internal "exile" followed in the wake of his open support to President Carter's move to cut off much of the grain sales to the Soviets, to deter American sportsmen from going to the Moscow Olympics and to persuade the "free world" allies to deter their sportsmen likewise. I see no physics in the matter of his exile and I don't see why PHYSICS TODAY should provide a forum for the Sakharov issue. It may even violate the AIP charter.

R. PARTHASARATHY

5/12/80 *Fairbanks, Alaska*

THE AUTHOR COMMENTS: It has often been argued as Rustum Roy does, that the free people in other nations can do little to help Soviet dissidents and that our attempts may even work to unravel the fragile fabric of peaceful relationships upon which the avoidance of nuclear war depends. To me Sakharov's response is both eloquent and convincing:[1]

> It seems obvious to me that a firm policy on human rights could not and cannot 'spoil' anything. On the contrary, it shows that the West . . . will resolutely defend the principles which hold such fundamental significance for our common future. Weakness or excessive 'flexibility' on human-rights matters immediately undermines Western positions all along the détente 'front' . . .
>
> As long as a country has no civil liberty, no freedom of information and no independent press, then there exists no effective body of public opinion to control the conduct of the government and its functionaries. Such a situation is not just a misfortune for citizens unprotected against tyranny and lawlessness; it is a menace to international security . . .
>
> As to the possible forms of pressure appropriate in securing human rights, we must bear in mind that a specific human-rights matter can be solved only when it becomes a political problem for the leaders of the violator country. Détente creates various levers for exerting pressure which, without threatening to exhaust its potential, nonetheless brings specific human-rights questions as well as general problems to the attention of top policymakers. These levers are controlled not just by governmental and legislative bodies. There is a role for nongovernmental organizations and private citizens involved in exchanges—business firms, scientific associations, trade unions, workers, scholars, authors and artists. I am not suggesting blackmail, of course, but rather the adjustment of interests which is a normal part of the process of eliminating confrontation. Such measures as a partial and temporary boycott of scientific or cultural contracts, temporary embargo on certain specialized equipment, or a dock workers' embargo do not threaten détente . . .
>
> Dissenters demand respect for human rights, the development of democracy within the framework of the existing system, and the fulfillment of international undertakings; they reject violence on principle. Their voices do not reach top decision-makers; their appeals are answered largely with repression. Therefore the Western public and its political leaders, when speaking with the leaders of socialist nations, in fact represent not only their own people, but also those who have been deprived of a voice in their own countries.

Note, however, that Sakharov carefully avoided suggesting any *total* boycott of the Soviets. It is important to keep the communication channels open and the machinery that facilitates exchanges in place, so as to prevent the level of mutual understanding between the US and USSR from declining ot its dangerously low Cold War level and to make possible a quick return to "normalcy" if the Soviet government reverses its current movement toward ever more brutal treatment of dissidents. The efforts of Roy and others of like mind to encourage exchange *need not* therefore undermine the impact of the decisions of those who refuse *as individuals* to participate in *official* exchanges pending the freeing of Sakharov. This would be true especially if those who work to keep channels open take pains to make clear to the Soviet government that their efforts should in no way be misunderstood as acceptance of the imprisonment and mistreatment by the Soviet government of the finest members of the Soviet scientific community.

As to Roy's suggestion that "continued cooperation will give the USSR Academy the maximum positive leverage to exercise in their much better informed ways to effect some change," I am moved to remind Roy that Sakharov is the most courageous member of the Soviet Academy of Sciences and is surely the most knowledgeable on the situation of Soviet dissenters. Nevertheless the leadership of the Soviet Academy has repeatedly been pressured into denouncing Sakharov. Fortunately the Academy's rank-and-file membership has thus far refused to vote Sakharov's expulsion by the required two thirds majority on a secret ballot.

I believe that this silent resistance within the Academy is due, at least in part, to the protests of foreign scientists over the Soviet Government's treatment of Sakharov. If this is the case then we are *helping* the Soviet Academy resist the pressure from the Soviet government by pressing them from the opposite side. Pressure can be welcome. Thus Franklin D. Roosevelt once said to a visitor, "You've convinced me. Now go out and bring pressure on me."[2]

I am happy that Roy agrees that "scientists should get informed and involved." And I do appreciate his willingness to contribute to the debate. It is critical, however, that we work to keep the issue of the dissident Soviet scientists before world opinion. Sakharov carried a large part of this burden until his voice was stilled. Free scientists must now pick up that burden. Are we up to it?

As far as Sakharov's contributions to physics are concerned, R. Pathasarathy obviously would have benefited had he been able to attend the special evening session at this year's Washington APS meeting. This session was devoted entirely to a discussion of Sakharov's contributions to the areas of magnetic fusion and elementary-particle theory.

Pathasarathy is equally wrong when he discusses the timing of Sakharov's exile relative to the US moves to put pressure on the Soviet Union to leave Afghanistan.

Finally, it would be a sorry situation indeed if it were a violation of the AIP charter for PHYSICS TODAY to carry a discussion of how free US physicists can help a colleague who is being persecuted because he has, in the words of the Nobel Peace Prize Award, become "the spokesman for the conscience of mankind."

References

1. D. Sakharov, *Alarm and Hope*, Vintage Books, New York (1978), pages 171–173 and 108–111.
2. Quoted in: J. Primack, F. von Hippel, *Advice and Dissent, Scientists in the Political Arena*, New American Library, New York (1974), page 125.

FRANK VON HIPPEL

5/14/80 *Princeton University*

Spirit of physics gone

This letter might well be titled "It makes me laugh!" I speak of the ads in Information Exchange—Positions Open—in PHYSICS TODAY.

Repeatedly we read such phrases as "PhD required . . ."
"Good lecturing ability . . ."
"Strong commitment to teaching undergraduate courses . . ."
"Commitment to research . . ."
"The candidate will be measured by his ability to teach at all levels—lower and upper, undergraduate and graduate—while carrying on effective research . . ."
and all of these things in the one "pitch."

I ask you: Do such men now exist? I have not seen one for years! A young PhD knows that his salvation lies in his doing research. In the *big schools* this is a *must. And no one looks at his teaching.* In the small schools they are also mutually exclusive and there is little or no provision for doing research. Ask the undergraduates what they think of their courses and the teaching they suffer! And ask the graduate students what they think *of all of it*! There was—once-upon-a-time in my own younger years—another atmosphere where the *spirit of physics* prevailed. I think it is now all gone.

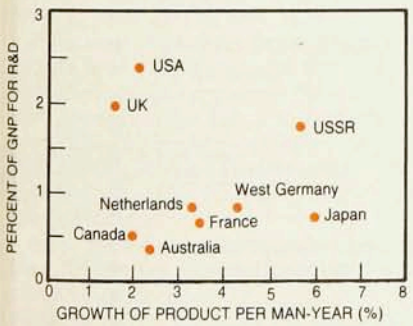
JULIUS SUMNER MILLER
5/22/80 *Torrance, California*

Efficient funding

Your editorial for May (page 36) states that "economists have good evidence that advance in fundamental knowledge has been the single biggest source of economic growth in the past, making possible the high-technology products that enable us to compete in the world market," and you commend budget increases for science.

But if we consider the evidence in the accompanying graph from John Ziman's "The Force of Knowledge" (Cambridge University Press, 1976), it is clear that the cost/effectiveness of our R&D is far below that of Germany or Japan.

What that graph suggests is that the allocation of resources within the overall R&D program may be far more important than the absolute amounts invested. One can even imagine a pattern of misallocation so inefficient that increases in total expenditure will actually be counterproductive by diverting resources from the more productive to the less productive areas of investment. Might this be the interpretation of the well-advertised "innovation recession"?



Funding for R&D versus rate of economic growth for various countries during 1951-1960.

It is clear that if we are to serve the national interest as well as our own professional interests, we should devote at least as much attention to a critical review of the efficiency of our systems of resource allocation as we do to the size of our gross budgets.

LAWRENCE CRANBERG
6/2/80 *Austin, Texas*

Intractable energy problem

The letter "Action on Energy" by Morton and Judith Tavel (March, page 114) presented questions and frustrations that many have had regarding the failure of our country to realistically develop technical solutions to the energy-supply problem. In the absence of a scientist who today could influence the government to undertake an effective course of action, the Tavels propose that the professional scientific societies select a delegation of unbiased experts to analyze the alternatives, draw conclusions and somehow bring about a directed program that would assure adequate energy availability in the future.

With the stated hope of stimulating response, their letter reiterated the urgency of the energy problem and offered this course of action as a possible path to a solution. I share completely their expressions of concern and despondency about the present national course. In seeking a remedy, however, it should be noted there are two aspects of the situation that make the problem particularly intractable and different from other technical challenges, such as the Manhattan Project and the Apollo Program.

First, the energy sources and the means for conversion into useful forms that will be used on a significant scale in the future will be determined by cost factors. This means that in the final analysis, the engineering aspects of applying the scientific principles will be overriding. History will verify that in the environment of our economic system, the struggle of international competition and the demand for higher standard of living, society will not accept any means for providing basic energy requirements that are appreciably more expensive than the alternatives. The eventual cost of delivered energy from any one of the new approaches being proposed is difficult to estimate, since it will be determined primarily by the success of the final engineering and large scale operational experience. Thus, the best choices for energy sources and energy conversion methods to be developed in the future cannot be quantitatively identified today.

The second aspect of today's situation that makes the problem so intractable is largely a consequence of the first, just described. The difficulty of foreseeing the degree of success eventually attainable in large-scale engineering applications has resulted in a national arena where special interests are being served through claims that cannot be disproven or substantiated. Every conceivable technical approach to future energy supply seems to be accorded a measure of credibility.

The organizations performing research and development in industry, and in the not-for-profit institutions and universities, promote and even misrepresent favorite schemes to secure funding. Environmentalists and organized public groups attack certain approaches and promote others relating to energy supply, often employing statements of questionable validity. Legislators employ similar tactics to best serve their constituency or their particular political objective. And even within the government agencies and other organizations sponsoring research and development there exists a competition among factions assigned to further the different approaches to the energy puzzle. The result has been a continuing clash of claims and counterclaims as to which of the large number of possible methods for energy supply have greatest merit. It is no surprise that clear directions for the national effort have not emerged from this confusion.

Returning to the suggestion by Morton and Judith Tavel that a delegation of experts from the country's scientific organizations analyze the options and recommend a course, essentially even this has been attempted. One example was the "Cornell Workshops on the Major Issues of a National Energy Research and Development Program," whose conclusions were reported in 1973.[1] Another was the "National Research Council's Committee on Nuclear and Alternative Energy Systems," whose report was issued last year.[2] Why do not the recommendations of such competent scientific groups made in the national interest have more influence on the national program?

Two reasons as to why have been discussed in this letter. While the outcome of the technical and engineering competition among different