tional facilities in the home country would prevent a student trained abroad from teaching what he has learned. I feel that it is the principles one learns that are most important, rather than what tools he uses to learn them. As long as the student is able to adapt these principles to conditions at home, he will feel no dissatisfaction when he returns home. Besides, what the student learns outside the classroom and the laboratory goes a long way toward educating the individual and ultimately, through him, many others. In this sense, I feel, students should always be encouraged to visit foreign countries to further their own education and ultimately be useful to their countries.

The idea of "exporting universities," however, is a good one, but it would create more problems than we imagine.

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Discovery and Obligation

The editorial "The jinni in the bottle" [*Science* **134**, 359 (11 Aug. 1961)] ends with the curious questions whether the scientist can be expected "to differentiate his role as a scientist from his role as a citizen," and what can fairly be asked of a scientist in relation to anticipated social consequences of his discoveries. It is implied in these questions that his scientific activity divorces the investigator from his responsibilities as an ordinary human being. No such assumption is ever made, nor is its necessity felt, if the economic and social consequences of discoveries are pleasant ones, conferring benefit on humanity. It is even taken for granted, and justly so, that a scientist shall, if necessary, battle the vested interests, academic or otherwise, and openly oppose entrenched ideas and practices once his discoveries have convinced him that doing so is required by the public welfare. Many of our greatest scientists have assumed this responsibility at a heavy cost in personal comfort and peace. Why should the situation be different if the potential consequences of a discovery bode ill for humanity?

Your editorialist concludes reasonably that there is little point in recoiling from a discovery and in putting "the jinni back into the bottle," since, "if he stops, someone else will continue." Un-

less scientists arrogate to themselves ethical standards apart from others, their duty cannot be in doubt. Discoveries are made at the risk of the investigator. Knowledge confers obligation. It is not enough for the scientist to make his discovery public; it is his clear duty to set forth any evil consequences that may be brought about by it, to give warning to those most likely to be able to forestall harmful effects, and to enlighten the public.

WALTER LANDAUER
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With reference to the editorial "The jinni in the bottle," we should never allow any jinni (new knowledge) to be kept in the bottle.

Neither war nor peace is an act of God; both are caused by man, and it is important to realize that knowledge used to fabricate weapons to wage war may ultimately be useful for the waging of peace. The nitrogen mustards and organic phosphates, gases for war, ultimately proved to be of value in cancer chemotherapy and insect control, respectively. Atomic energy itself has also led to weapons for peace heretofore visualized only by the prophets of science.

What man has made for war man can also use for peace.

R. H. ADAMSON
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The writer of the excellent editorial "The jinni in the bottle" begins with the interesting pastime of undoing history in order to rewrite it, but proceeds to the very real question of whether a scientist can separate his role of scientist from his role as citizen.

The question is raised in connection with the development of nuclear weapons, resulting from basic scientific work in nuclear physics, and extends to the possibility of undesirable effects if large-scale control of weather, genetic material, and so on should become possible.

The dichotomy, it seems to me, is not between the scientist as scientist and as citizen but between the scientist as scientist and as human being. If a scientist anticipates abuse of his discoveries as a probable future event, he should discontinue his work; otherwise, he personally becomes morally and socially responsible for this abuse. The mere fact that, if he discontinues, somebody else may pick up the threads and continue does not absolve him from his

responsibility. If this reasoning were to hold, it would absolve any driver arrested for a traffic violation because he could say if he had not speeded, somebody else would have.

In former times, this sense of personal responsibility was strongly developed, and it may be well to remember that Leonardo refused to disclose the invention of a submarine because he foresaw the evil use to which such an invention might be put.

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Classroom Teaching and Research

Your editorial "The system," in a recent issue of *Science* [**134**, 159 (21 July 1961)] deals with what I regard as one of the most important and troublesome problems facing our universities, but one which is generally ignored. Partly as a result of our desire to increase research activity and partly because of the availability of research funds in nearly all fields, the best minds in our universities are being diverted from undergraduate teaching to research and graduate teaching.

Our energetic young staff members try to get out of beginning courses as soon as possible in order to have more time for research. If the present trend continues, only those staff members lacking the initiative and imagination to obtain research grants will be left to do our undergraduate teaching. We can scarcely expect such people to be effective in attracting bright young students into graduate school. In fact, they cannot even give the general student body the kind of background it needs.

The effects on undergraduate teaching of our excessive preoccupation with research on university campuses is seen in the fact that most of our graduate students come from colleges where little research is done, and relatively few come from universities where research occupies much of the time and energy of the staff.

You suggest that perhaps undergraduate teaching will be left largely to the four-year colleges, but they also are beginning to develop research programs which will divert an increasing proportion of the time and energy of their staff members away from teaching. As I hear college administrators asking for money to develop research programs, I wonder if they realize how this may affect their teaching programs.