ences. If it is found that this education is indeed not generally satisfactory, the study group might then examine various formal and informal remedies.

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Scientists in Public Affairs

In your "News and Comment" for 4 October 1963 (*Science* **142**, 34), Dan Greenberg reviews with his usual felicity the reaction to Snow regarding the scientists' role in public affairs. It prompted me to reflect once again, however, how badly this important issue has fared in the public debate, at least that portion of it which has received the most notice.

Snow must bear some of the responsibility for the present state of the discussion. He maintains that the scientist must play a larger and more decisive role in public affairs because the scientist is by ability and especially by training better suited to make major decisions and better equipped with foresight. He also has expressed despair at the present situation in which administrators with little or no knowledge of modern science make decisions involving science—a dangerous situation which he believes will not be righted until we have administrators who have received a first-rate scientific education. This is a fairly naive analysis of the situation, but it has unfortunately established the basis of the debate and determined the direction of the responses. So we have Leavis's intemperate attack on Snow which really starts off from a low opinion of Snow's novels but extends this judgment to imply disapproval of his failings in other respects; Hutchins, rousing his wit once more to fight again the old battles with his faculty at the University of Chicago; and Lilienthal countering with the observation that scientists tend to transfer improperly to other fields the confidence they cultivate through their success in their laboratories. This line of argument follows, of course, from Snow's notion that the scientist is specially gifted for administration of public affairs in today's world by virtue of being a scientist, thus inviting the *argumentum ad hominem*, which gets us nowhere.

In most cases of public decisions of great significance which have involved science in recent years, the real difficulty was not that the administrator did not know enough science or failed to listen to the best scientists or that he lacked foresight. The decision was rendered difficult either because of a lack of adequate scientific or technological knowledge required for the decision, or—the more common and significant situation—because disagreement developed among scientists concerning the conclusions to be drawn from the scientific knowledge available. A good scientific background would not have been much help to President Truman in deciding between those who sided with Teller and those who sided with Oppenheimer, and he probably would have had a hard time finding an equally eminent scientist who would have been above the battle and able to resolve his dilemma.

What renders particularly complex the decisions in the public domain that involve science is that, in the final analysis, they are not scientific in nature. Is the risk of some increase in leukemia in the next generation too big a price to pay for scientific progress and the national security? Eminent scientists have argued inconclusively over this question, but is it basically a scientific question? Whether we can land a man on the moon within this decade is a question for scientists and engineers to decide, but whether we should is no more their special province than that of lawyers or doctors or toolmakers. How much of the national income should be devoted to scientific research, and what possible areas of research should be favored? Scientists are very much interested in this question, but so much more is involved than science that all of the related factors do not lie within the range of the special competence of scientists. There exists, moreover, the subtle danger that, although scientists must of necessity play a major role in providing the basis for sound judgment in such matters, the scientist as an individual is subject to a serious conflict of interest which may color his view of the political and social implications of his conclusions.

These considerations are not meant to imply that public administrators today are better off if they are ignorant of science, and speaking as a nonscientist, I would hope that something better is done for the scientific education of nonscientists than is generally available now. Nor are they meant to imply that individual scientists are unlikely to possess the talents required to provide leadership in public affairs or the character to set aside their private interests in reflecting on large issues of national policy. They are meant to suggest, however, that unless the realities of the situation are taken seriously into account, the debate over the place of the scientist in public affairs today and his fitness to play a decisive role therein is not likely to rise above the confused and contentious level represented by the summary of opinions in your review.

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Jargon Addon

I respectfully submit that in his "Jargon of genetics" [*Science* **143**, 195 (17 Jan. 1964)] the glorious Fulton should have included the following two units:

Fion: unit of disapproval.

Knownon (nonon): unit of ignorance or nonsense.

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Metric System: Small Quid for a Large Quo

When I read Joseph Mayer's letter about the "metric question" [*Science* **142**, 1123 (29 Nov. 1963)], I recalled the course in "pharmaceutical arithmetic" my colleagues in the United States had to take because of the antiquated systems of measuring still in use in your otherwise certainly very progressive country. In continental Europe every child is able to understand the measures because they are simple and logical.

Here we live in a country deeply rooted in traditions: on our century-old city hall the Lucerne "foot" and "cubit" are still shown on an iron bar. We are very grateful that our forebears were nevertheless willing to abandon cherished traditions in favor of a rational and scientific system.

Frost and Weber in their letters in the same issue have replied very well to Mayer. I would add only this: The

great majority of non-English-speaking nations recognize the value of the English language in international understanding, especially for scientific fields. Millions of people have spent years in learning English, and they do not regret it. Is it too much to ask the nations which have the advantage of learning English as their first language to spend a few hours to become familiar with the easily learned metric system?

Thanks again to the editors of *Science* for adopting it.

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A recent spate of letters advocating adoption of the metric system in *Science* and elsewhere led me to wonder how our colleagues in the engineering fields felt about the question. I was heartened to see, recently, the editorial in the May issue of the *Journal of the Water Pollution Control Federation*, in which it was announced that thereafter all papers in that journal would include metric units along with the customary English units. This is in line with an action taken in January by the American Society for Testing and Materials. The editor takes the enlightened position that, since the engineering profession is the principal group affected by such a change, the engineers are in an influential position to foster a progressive conversion.

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Pacific Science Center

I agree that the Pacific Science Center, which you describe in your editorial of 18 October [*Science* **142**, 345 (1963)], is worth supporting. However, your description of reactions to the Seattle Fair's United States Science Pavilion, which will now become the Pacific Science Center, is inaccurate. I base this assertion on a study, which I directed, of visitors at the Fair.

You quote a report that the Pavilion proved its popularity because "More than two out of three visitors (6,770,109 out of 9,609,969) sought out the exhibit. . . ." Statistics about attendance at fairs should be treated cautiously. Fair operators know only how many tickets they sell, not how many different people buy them; they do not know their "repeat rate." Pavilion managers get a rough idea of the size of their attendance by trying to count those entering their doorway, but they, too, have no idea what the repeat rate is. On the basis of our small-scale studies of repeat rates and of pavilion attendances, I would estimate total attendance at the Fair at between 4.5 and 5 million, and attendance at the Science Pavilion at between 60 and 80 percent of that total, with the higher value more likely. The fact that most of the Fair visitors came to the Science Pavilion did not in itself demonstrate that the exhibits within were successful. There were at least two reasons for the Science Pavilion's popularity which had nothing to do with value of the exhibits: the buildings were imposing, and there wasn't much competition.

We spent some time on the question of what fair-goers gained from a visit to Building Four of the Science Pavilion, which housed a great many extremely ambitious exhibits. Our conclusions were: (i) Most visitors were impressed, even awed, by the exhibits. (A frequent response on leaving the building was "It's all just wonderful.") (ii) Few people added appreciably to their knowledge of scientific facts or theories. (iii) Many visitors gained a sense of first-hand experience with scientific instruments and products. (A satellite-tracking station, a spark chamber, and a functioning biological laboratory were three of the more ambitious exhibits.) Science thereby became less foreign, though not more understandable.

I would guess that at least some visitors would have been disappointed —and properly so—if the exhibits had been more understandable, since this could have been accomplished only by watering down their content. The complex exhibits actually presented were respected because they were uncompromising in their aims. So long as a visitor felt he understood the general idea of what he was being shown, he was likely to believe the experience a valuable one. Along this line, it might have been better had working scientists, rather than college students, conducted the demonstrations. As it was, visitors did not have an opportunity to form an impression of that most important aspect of science—the scientists.

The statement in your editorial that "Imaginative exhibits on basic science hold the interest of a large public if technical jargon is avoided . . ." mistakes what it is that enables an exhibit to hold an audience. In Seattle both demonstrated exhibits and exhibits featuring live animals held the interest of visitors for quite a while, but otherwise the average length of stay at an exhibit was never more than 1½ minutes, and more often than not was 50 seconds or less.

There was one aspect of the Science Pavilion to which too little notice has been given. That was the Children's Pavilion, directed by Mike Butler and open only to children 16 and under. Some of the exhibits there had a surprising capacity to engage and instruct the young.

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Shortage of Medical Students

One must respect the long experience of G. H. Whipple in medical education. Much of what he says in his letter [*Science* **142**, 541 (1963)] is basic to understanding the problem facing the country.

In earlier years most of the medical graduates flowed in the direction of medical practice, that is, direct service to the public. This flow is now marked by many deviations. New fields have developed very fast and are attracting many. A mere listing will include the increase in full-time academic medicine (clinical, preclinical, and research), administration, public health, insurance, occupational medicine, athletics, and careers in the armed forces and the Veterans Administration. Of the more than 7000 annually completing their medical education, large numbers are not available to a burgeoning population. Innumerable communities are in dire need of medical service. Increased enrollment is therefore vital.

Whipple says that "Many good students . . . come from hard-working families with no financial reserves." I submit that with an annual requirement of approximately $3000, many can hardly manage. Scholarships at best are supplementary. The student's program is sufficiently time-consuming and stringent that to take on outside work is dangerous to his health and to his scholastic standing.

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