

private and public communications in physics

By Michael J. Moravcsik

The opinions expressed below are those of an individual, theorist M. Moravcsik of the University of California's Lawrence Radiation Laboratory at Livermore, and thus should not be construed as being necessarily representative of views held in AIP, APS, LRL, BNL, etc. They do, however, provide a basis for wider discussion of a problem of pressing concern to all physicists, and in that light they are presented here.

The problem of communication among physicists has grown more and more acute in the past few years. Discussions of this crisis have ranged from innumerable bull sessions during coffee breaks, through frequent editorials in scientific journals, up to a formal report of a special panel of the President's Scientific Advisory Committee, headed by Alvin Weinberg.*

Almost two years have passed since the Weinberg panel issued its report. It was a thorough and well-considered study, containing a large number of recommendations. I am not sufficiently familiar with the detailed organization of the various sciences to be able to tell whether, on the whole, the Weinberg report's recommendations have been realized or not. I do know, however, that in that sector of physics which I have contact with, and among the physicists I know, its suggestions have, so far, had a negligible impact. In a sense, this is not surprising, since a comprehensive study like the Weinberg report has, in addition to its many advantages, at least two drawbacks. First, by its very nature, its recommendations involve new organizations or new programs on a large scale, which have to be established by the government or by large private institutions, and, as such, require time, money, and initiative which are not always present. Second, again by the same aspect of its nature, its recommendations appear, at first sight, to be unsuited to any action an individual scientist, or a small group of scientists, can undertake on their own, and hence do

not foster the feeling of individual responsibility and participation which the Weinberg report, in the abstract sense, stressed very emphatically.

The purpose of the present article is, therefore, to make a few very specific suggestions concerning the communication problem in physics. They are, at best, partial realizations of the recommendations of the Weinberg panel, and can be considered as stopgap measures until permanent remedy arrives through the large-scale reorganization of our scientific communication habits. Neither are they a complete answer to the problems involved. Rather, they are simply a collection of ideas, which might either be tested in practice, or, if they prove to be too "outrageous", will, I hope, be replaced by better ideas by others. Their advantage lies in the fact that they are all easily realizable by a small group of physicists in a short time with essentially no investment of money. I believe that, just as in foreign aid, there is room, beside the large-scale development projects, for local "self-aid" projects furnishing quick, partial relief to specific bothersome problems.

I would also like to make clear that I would be reluctant to claim originality for any of the suggestions outlined below, since, although they are my own in a direct sense, they stem from a large number of conversations throughout the years with many of my colleagues. Some of the suggestions are also in tune with the recommendations of the Weinberg report which, I am ashamed to confess, I read only after the first draft of this paper was completed.

To complete the introduction, I would also like to add that this article is not intended to be a criticism of the so-called documentalists, who have

* Science, Government, and Information. A Report of The President's Science Advisory Committee, US Government Printing Office, January 10, 1963, Washington, D. C.

been mainly responsible in the past for scientific communication. On the contrary, I believe that if the present suggestions were to be put in practice, the work of the documentalists would be facilitated by the direct participation of the physics community as a whole.

1. Utilization of printed communications

With the recent proliferation of journals and the increase of physicists it has become more and more difficult to keep up with the published literature even in one's own field of interest. Most of us subscribe only to one or two journals, and only occasionally scan the rest of the publications in the library. To be sure, preprints are widely used in keeping people up to date. The distribution of preprints is, however, a very haphazard procedure, benefiting mainly those who are already well established in a field, thus penalizing the young physicists and those outside the large centers of scientific research. It also inhibits those who are developing an interest in a new field and are in the process of establishing themselves in it. Abstracting journals are, of course, available and contain fair indices, but they are expensive to subscribe to for an individual; they contain, from the point of view of each individual, mostly irrelevant information; and they operate with a considerable time lag. This last feature is particularly important, since in many branches of physics development is so fast that a year-old piece of information has only a small fraction of its original value.

I would like to advance therefore the following two suggestions:

Suggestion 1A: *The Physical Review* and other research journals should reprint, in each of their issues, the tables of contents of the recent issues of the other important journals of the same kind. With a reasonable amount of cooperation among the editors of journals it should be possible to arrange that these tables of contents be reprinted almost simultaneously with appearance of the issues in question. The size of, say, *The Physical Review*, already some 200-300 pages per issue, would thus be increased at most by 15 to 20 pages per issue, a negligible amount indeed.

Suggestion 1B: Custodians should be appointed to keep track of the bibliography in a given field. Under this system, a physicist, already working in the field, would be responsible for maintaining a record of the literature in this field. He would have the duty of discovering newly published ar-

ticles (this would be greatly facilitated by suggestion 1A), receiving new preprints, and making such a list available, upon request, to other physicists in the field. The topics could be made narrow enough (e.g.: pion-nucleon elastic scattering, experimental) so that the job could be easily handled by one interested person with no serious demands on his time. The list of these custodians would be announced in journals so that all new preprints could be sent to him and all prospective customers would know where to write to him. This suggestion can be easily organized, its costs are negligible, and it can be put into effect almost immediately. For the sake of simplicity it would be advisable not to make it retroactive; i.e., the custodian would be responsible only for literature created after he assumed his duties.

2. Improvement of printed communications

This aspect of scientific communication has received perhaps the most attention in past years. Discussion has centered around two main topics: The selection of what should be published and where, and the format of the publications. In these respects I would like to make two suggestions concerning format, and two suggestions concerning editorial policy.

Suggestion 2A: A standard format should be established for articles in a given journal, and sub-headings conforming to this format should be required on each article. Such a format could, for instance, be as follows: (1) Introduction: purpose of paper, background, and justification; (2) Computational technique or experimental equipment; (3) Details of the calculation or experiment; (4) Results and interpretation; (5) Summary and conclusions. Articles published today in *The Physical Review* often conform to such a format, but other journals, notably *Physical Review Letters*, do not, resulting in considerable confusion and waste of time. The brevity of a publication is not an excuse for lack of organization. A format would greatly facilitate abstracting, reviewing, and refereeing scientific papers and would also help in exposing imperfections in articles.

There might be rare exceptions when a paper would not fit the standard mold, but in general, since the length of each section remains unspecified, the scheme should cover most publications adequately. I would therefore make it the author's responsibility to argue his case if he wishes to depart from the standard format.

Suggestion 2B: Printing of abstracts in the *Bulle-*

tin of the American Physical Society should be abandoned, and instead the text of invited talks should be printed in full. I believe that it is time that we get rid of many pretensions surrounding the meetings of the Physical Society. Firstly, it is still unfortunately true that for many physicists the prerequisite for the trip to a meeting is the submission of an abstract for a talk. Since a working physicist is always capable of giving a ten-minute talk on his work, this is certainly no inhibition on anybody who wishes to go to a meeting. It does, however, result in a large number of unnecessary and valueless talks. Secondly, even if the talk itself is of interest to the few who work in the same field, the abstract is usually not. This is so mainly because the abstract is due many weeks before the talk is given. Since interesting contributed papers involve mostly very recent work, the results are very seldom available at the time when the abstract is due. These circumstances have developed, by necessity, the art of writing abstracts in the past tense on work to be done (or in progress). The result, of course, is most often a collection of clichés and vague remarks, at best stating the intent and promising results at the meeting. I submit that these abstracts are, therefore, almost completely valueless and do not merit permanent record. The talks should simply be listed by their titles, which should be sufficiently informative to attract the appropriate specialists. On the other hand, the invited talks at the Society's meetings have assumed an increasingly important role, and are usually extremely valuable in giving periodic surveys of certain fields, usually by a competent speaker. With the increasing specialization of physics and the accelerating pace of research, such analytic reviews have a considerable didactic value. Since they usually do not depend on last-minute results, and since the speaker is usually given ample time to develop his subject, the organization and delivery of such invited talks are considerably superior to the contributed utterances. And yet, until now, these invited talks have received a treatment inferior to that of the contributed papers, since only their titles have been given in print. I do not believe that it is too much of an imposition to ask the invited speakers to submit typewritten manuscripts of their talk simultaneously with the meeting, so that they can be reprinted in the next *Bulletin*. A very rough calculation also suggests that the size of the *Bulletin* would remain approximately constant as the result of this change, since the extra space needed for the invited papers would be available through the elimination of the contributed abstracts.

3. Improvements in the refereeing system

Suggestion 3A: Manuscripts submitted to journals should be given to the referees without the name of the author. This is a logical extension of the present practice which keeps the referees anonymous. It would tend to ensure the absence of any "personality cult" and would eliminate many sources of personal friction. I realize that this suggestion cannot be carried out with 100 percent efficiency, since preprints often reach the referee before he is asked to referee a paper, and because often the author's personal style and his affinity to refer to his own published papers would give him away. Nevertheless, I believe that the realization of this suggestion would be beneficial in a very large number of cases.

Suggestion 3B: If a manuscript submitted to a journal for publication is criticized by a referee on other than trivial grounds (by trivial grounds I mean minor remarks on style, omitted references, misprints in formulae, etc.), the author should be given the choice of (a) withdrawing his manuscript, (b) conforming with the referee's recommendations, or (c) having his paper published together with the referee's report. The report of the referee, however, would remain anonymous. This suggestion is prompted by a number of observations. First, the present refereeing system penalizes articles advocating unconventional ideas since most referees are prominent representatives of their field and hence often too much committed to the schools they represent. The above suggestion would remove this inhibition to some extent, but not altogether, since the "dubious" paper would appear together with a presumably well-argued rebuttal by the referee which the author might not wish to see in print. Admittedly, this system would open the door to some genuinely crackpot articles, which perhaps could be circumvented by requiring that a fellow of the American Physical Society attest to the general scientific competence of the author. I doubt, however, that such cases would arise frequently. Second, I believe that this suggestion would raise the standard of refereeing by introducing the possibility that the referee's report be made public. I am fairly certain that a quick opinion survey among physicists would immediately disclose that there is a need for such a rise in standards, particularly in connection with the *Physical Review Letters*. Thirdly, I believe that, in the case of genuinely controversial papers, the referee's report would be a valuable contribution to the issue being discussed, and would greatly stimulate further think-

ing on the subject by conspicuously exhibiting the controversial problem. This would particularly benefit those physicists who, by necessity, carry out their work in an isolated environment (i.e., in a small institution, or in a scientifically underdeveloped country), and who therefore do not often have the benefit of participating in scientific debates.

4. Preprints and private communications

Preprints have become the main avenue of communication in many fields of physics. Nevertheless, as I have already mentioned, the distribution of preprints is done in a very disorganized and wasteful way, penalizing those who are shy, introverted, isolated, or young. I have two suggestions aimed at improving the preprint situation.

Suggestion 4A: For each large field of physics (e.g., elementary-particle physics) a central preprint registry should be established. This would be located at some institution active in the field, and would consist of one full or part time clerk whose duty would be to list the title, author, and author's institution of preprints arriving in the registry, and publish the list, say, fortnightly. The list could be obtained on a subscription basis by anybody in the world, by air mail.

Actually, such a system (or to be precise, several such systems) already exist, at least in the field of elementary-particle physics. For instance, the Physics Department of Brookhaven National Laboratory issues such a mimeographed list of the papers its preprint library receives, but this is not generally known, so that not all relevant preprints reach the library, and not everybody who could make use of the list takes advantage of this service. I do not, of course, suggest that the Department would at this time be prepared to distribute its list, free of charge, to thousands of individuals on a regular basis. It would take, however, only a little publicity and a minimum amount of organization to rearrange the present practice to serve the purpose I advocate. Once this is done, many other organizations, at present almost duplicating the job by distributing their own lists, could restrict their own mailing list to their own members. Again, the proposed system would particularly benefit those colleagues of ours who work in isolation in scientifically underdeveloped countries. Whether a small fee should be charged for the subscription or whether some government agency would be willing to support so worthwhile a project is a detail which, I am sure, could be easily settled. I might add that

while this suggestion to some extent overlaps with Suggestion 1B, they do not supersede each other, because some publications either have not appeared as preprints or are altered in the process of publication, and because preprints do not contain a reference to the final record of the work, and hence their listing is of little use except at the very time they appear.

Suggestion 4B: Each small group of physicists working in a given field should establish for itself a preprint library, whose address would be made available to the people in the field to be put on the mailing list. With the increasing number of physicists working in each field it is becoming impossible to send out enough preprints to cover everybody individually. Nor is it really necessary to do so, since most of us are sincerely interested only in a rather small fraction of the preprints we receive. Thus, if, say, four or five people could form a group with one address on preprint mailing lists, the situation would greatly improve. This is done, to some extent, in certain institutions, but it is not nearly prevalent enough. This system would also drastically reduce the number of changes one has to make in one's preprint list, which in turn would permit the most efficient use of time- and labor-saving devices such as addressographs or Xeroxed labels.

As advertised, most of the foregoing suggestions could be tried out without dependence on a large-scale organization or large financial investment, and hence without the cooperation of formal organizations. They do depend, however, on the cooperation, and hence on the approval, of the majority of individual members of the physics community. I hope, therefore, that they will be discussed, criticized, and improved in informal conversations at meetings, in "private communications", or in local discussions at various institutions—and, if some of them are found attractive, that some spontaneous volunteers will arise to help in carrying them out. If we do this, we will act in the spirit of the exhortation in the preamble of the Weinberg report, according to which "... The working scientist must . . . share many of the burdens that have traditionally been carried by the professional documentalist. The technical community generally must devote a larger share than heretofore of its time and resources to the discriminating management of the ever-increasing technical record. Doing less will lead to fragmented and ineffective science and technology."