# Letters

## Science in Israel

The two recent editorials dealing with science in Israel [*Science* **129**, 869, 995 (1959)] have special interest to me, since, as a U.N. Technical Assistance consultant in Israel twice, I was involved in certain aspects of the problems described. I offer a personal opinion concerning particularly the second editorial, "Basic research a luxury?" I feel that the editorial exaggerates somewhat the actual differences in viewpoint which exist, and that it states the argument from a rather unrealistic point of view.

Fundamentally, I believe the question is not whether basic research is either a dispensable luxury or a vital necessity in Israel today, or even whether applied research should prevail at the expense of the basic. What is pertinent is the question of balance between the two, taking into account the fact that Israel is a small country of limited natural resources, suffering from stringent economic problems brought on by both heavy immigrant absorption and large but necessary outlays for national defense. Despite rumors to the contrary, Israel simply does not have at this time a sufficient number of adequately trained and seasoned scientists to meet all of the present demands for both basic and applied research. Thus, to some observers in and out of Israel, including myself, the greatest urgency *at this particular moment* is maximum effort in technological development. While the vital importance of maintaining as much basic and long-range research as the economy can support is not denied, nevertheless the country is limited in its total scientific resources.

Actually, the problem touched on has deeper sociological and emotional roots than the editorials indicate. The source of Israeli science lies in the older European tradition which rewards, with social and intellectual status, individuals identified with basic research. This attitude is rapidly disappearing in Israel, but one continues to meet it there frequently enough to comprehend its major formative influence on the intellectual values and career orientation of students entering scientific fields.

Finally, the editorial discussion of science in Israel might have pointed up a growing problem of major concern not only to Israel but also to a number of European countries as well. I refer to the extent to which these scientifically literate countries are being "raided" for scientific and technical talent by the United States. As a consequence, a serious threat appears to be developing not only to the scientific, academic, and technical welfare of these small countries themselves but, in the longer range, also to the vital interest which the United States has in the survival and strengthening of these democratic outposts.

It seems to me that the various United States governmental agencies responsible for allocating ever-increasing sums for research within the United States, should show greater concern for the fact that they may be heedlessly, but nevertheless seriously, weakening the scientific fiber of the smaller nations. A leading Israeli scientist made the point to me that the interests of the United States might be better served if a real effort were made to place U.S. Government projects for nonsensitive or nonclassified types of research in countries with capable scientists, such as Israel and several European and Asiatic countries whose survival is vital to our interests. Such a program would not only yield substantial savings in research costs but would also permit these countries to improve and expand their scientific and academic institutions.

A start has already been made in this direction by the U.S. Department of Agriculture, by allocating to research in several countries, including Israel, local currencies accumulating there by purchases of U.S. agricultural surpluses (Public Law 480). It seems to me that this small beginning could be expanded to the mutual advantage of the United States and democratic countries such as Israel whose welfare and survival concern us.


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## Mating for "Hybrid Vigor"

In his report "Hetero blood types and breeding performance," Mogens Plum [*Science* **129**, 781 (1959)], in discussing his data on the matings between 310 females and 32 males of the Holstein-Friesian breed, states, "The rate of survival increased as the difference in antigens increased. The chi-square of 8.72 is significant at 0.05 level." This chi-square of 8.72 is what might be termed the total chi-square for his data and is based on 3 degrees of freedom.

It is possible, of course, to calculate, from the data Plum gives in Table 1, three values of chi-square, based on a single degree of freedom each, which will add to 8.72. On the basis of the number of antigens in which mates differed, the following independent comparisons or degrees of freedom might be used: 1–5 versus 6–7, 1–5 plus 6–7 versus 8–9, and 1–5 plus 6–7 plus 8–9 versus 10–15. These comparisons and their chi-squares, together with other pertinent information, are given in the following table.

Summary of detailed chi-square analysis of data on matings between 310 females and 32 males of Holstein-Friesian breed, presented by M. Plum.

| Comparison | D/F | Sum of squares | Factor | $\chi^2$ | $p$* |
|---|---|---|---|---|---|
| 1–5 vs. 6–7 | 1 | 0.1675 | 4 | 0.670 | NS* |
| 1–5 + 6–7 vs. 8–9 | 1 | 0.0618 | 4 | 0.247 | NS* |
| 1–5 + 6–7 + 8–9 vs. 10–15 | 1 | 1.9511 | 4 | 7.804 | .01 |
| Total | 3 | 2.1804 | 4 | 8.721 | .05 |

* Level of significance; NS, not significant.

The results presented in this table indicate that, if dissimilarity of blood antigens may be used as a guide for mating for "hybrid vigor," the number of antigens in which mates differ must be equal to or greater than some minimal or threshold number of a given group of breeding animals in order to achieve the desired effect.

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## Using Theses for Scientific Communication

The increasingly critical problem of space limitation in scientific communication has recently received attention in *Science* editorials [*Science* **127**, 623, 1145 (1958)] and comments [**127**, 1458 (1958); **128**, 424 (1958); **129**, 118 (1959)]. Among the suggested solutions, the publication of journals in microform, the appearance of articles in abstract, and the availability of photocopies of desired manuscripts have all been advanced singly or in combination.

A letter by Phipps [*Science* **129**, 118 (1959)] is of especial interest because six attributes of a system for improvements in publication communicability are presented. He applied his criteria, however, to a seemingly radical departure from current practices, involving abridged articles, abstract cards, and photocopies. Although his standards were developed as a test for a hypothetical system of journal publication, most of the criteria can be used to evaluate a suggestion that I wish to propose as a more conservative method for overcoming space limitations in professional journals. The criteria are: (i) capability of evolving from the existing system; (ii) reduction of delays in communicating results; (iii) coverage of a broad range of scientific interests (reversal of the trend toward overspecialized journals); (iv) guarantee of self-determination to the individual author (elimination of editor-referee censorial power and of pressure toward abridgment of source material); (v) guarantee of self-determination to the individual subscriber; (vi) incurrence of no added cost.

The procedure to be indicated would seem to be of greatest value for an explanation in full of a methodological approach or theoretical system. It might have been used advantageously by one learning theorist who replied to critical reactions by saying that they "reflect a serious lack of understanding of the . . . basic theoretical framework . . ." (*1*). (Part of this lack of understanding was ascribed to an inadequate treatment which resulted from space limitations in journals, allowing only a brief and piecemeal theoretical discussion.) I used this procedure to advantage when I designed a series of experiments investigating the comparability of a pictureless Thematic Apperception Test (*2*) to the standard version (*3*). To insure objectivity in these comparisons, I compiled a scoring manual, involving some half dozen scales and full illustrative protocols indicating their application (*4*). While dittoed copies were prepared to be sent to interested scholars, copies will also be bound as appendixes in theses of graduate students in Virginia and Texas who are making use of them. Such binding insures scholarly permanence and availability on interlibrary loan should my supply become unavailable. In addition, this use of theses for scientific communication seems to meet four of Phipps criteria. For, it (i) is part of the existing system, (ii) reduces delays in communicating information, (iii) guarantees complete self-determination to individual authors (the cost of duplicating manuscript pages is but a minuscule fraction of the charges for printing them), (iv) involves no added cost. The two criteria not met are inapplicable. Furthermore, employment of the thesis as a medium for scientific communication may increase its audience and certainly serves to insure completeness. The former is desirable; the latter is recommended (*5*).

Without change in journal policy one may insure the full availability of material regarded as important, or, at least, used by fledgling researchers in their formulations. Theses are seldom in the forefront of tools available to all scholars, nor are they all indexed even as whole items. Hence when a person whose material is inserted in a thesis writes a journal article that concerns the subject treated in the inserted material, it behooves him to include in his article a reference to the thesis repository. Without such specific citation, the theoretical or methodological addendum might not become a part of the literature. More than a few people must know where the material is obtainable.

To this end, the form of citation of the thesis insert in a journal reference is important. It must indicate clearly the specific nature of the added explanatory matter and identify the thesis sufficiently