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	χ^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

to insure its location when requested by readers of the article. The form of reference *4*, below, is within the style of references appearing in *Science*, and could be easily adapted to editorial policies of other scientific bodies. If the material is bound in more than one thesis, as will be the present case, the writer might cite the copy available in the library more frequently used by his colleagues, or the one best equipped for rapid interlibrary loan, or, if he is associated with an academic institution himself, prestige considerations might dictate citation of his college library.

The use of graduate theses for scientific communication would seem to be a partial but satisfactory solution to the problem of diminished space and expanded output. Such usage might be welcomed by those who may need to familiarize themselves with the insert in only one such thesis for full background information on a series of journal publications. Journal space is scarce, ingenuity is not.

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"Feedback" in Evolution

In his review of *Behavior and Evolution* (Anne Roe and George G. Simpson, Eds.), C. H. Waddington [*Science* **129**, 203 (1959)] discusses the lack of emphasis by the several authors on the "various types of 'feedback' or circularity in the relation between an animal and its environment." He says that the relation of the behavior of an animal to the evolutionary process is not solely that of a product, but is also one of the factors which determines the magnitude and type of evolutionary pressure to which the animal will be subjected. Behavior is at the same time a producer of evolutionary change as well as a resultant of it.

In his recent articles, and particularly in his recent book *The Strategy of the Genes* (1957), Waddington has clearly demonstrated "genetic substitution" by means of evolutionary feedback through natural selection. I agree with Waddington that this process is important for an understanding of much adaptive evolution, including the evolution of adaptive behavior. However, in his book review, Waddington seems to have missed my discussion (pp. 319, 323, 331), which is in essential agreement with the point of view expressed by Waddington in his criticism, and which he says did not "emerge completely into the light of day." For the feedback from behavior to isolating mechanisms, a process that Waddington feels did not receive sufficient emphasis in the chapter by H. T. Spieth, I should also like to call attention to *Principles of Animal Ecology* (1949), by Allee, Emerson, Park, Park, and Schmidt, for a discussion of this point (pp. 619, 630, 695).

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It was only the feeling that my review was already unduly long that prevented me from giving references to the few remarks, such as those in Emerson's interesting paper, which referred to "feedback" relationships in evolution. The passage in which I expressed a wish to have heard more about such matters was not so much a criticism as it was a comment prompted by the British convention that no review, however favorable, should suggest that a book is quite incapable of being improved. After all, "feedback" is, at least in connection with biology, a rather vague concept; I still think it requires a good deal more discussion and experiment than has yet been devoted to it.

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Biological Bromination

In the 20 March issue of *Science* [**129**, 778 (1959)], J. W. Burger and Ti Li Loo give an interesting account of bromination of phenol red by the dogfish. However, they state that there appears to be no recorded instance of bromine being incorporated into an experimentally introduced exogenous material. Attention is invited to the fact that we have shown [*Proc. Soc. Exptl. Biol. Med.* **80**, 241 (1952)] that dibromindigo appears in the urine of rats after intragastric injections of hexabromostearic acid.

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We thank McClendon and Gershon-Cohen for bringing their article to our attention.

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