DISCUSSION

NOTE ON SCIENTIFIC WRITING

DURING the last six months I have analyzed from the point of view of their composition perhaps fifty scientific articles. My survey (if merely red-penciling errors and stylistic infelicities may be so dignified) was startling in its revelation of how badly a great many American scientists actually do write.

True, except for professional literary men, scientists probably write no worse than any other group of persons. But cumulatively their writings, even some of the most fugitive of them, are more meaningful and ultimately more valuable to society than are those of any other group. For that reason and for the wider diffusion of scientific achievement and thought, what the individual scientist has to say he should put in as simple, forceful, direct and understandable a manner as possible. Any deviation from that norm, by wearying and repelling readers, interferes with the widest communication and diffusion of scientific knowledge.

Several of the more frequently occurring of these deviations I wish to call to the attention of the scientists. All these errors add to the burden of the reader by forcing him to make needless and often trifling judgments. None of the errors, however, are very difficult to correct if the writer will pay conscious attention to overcoming them in his manuscript revision. Since I can not lay down any hard and fast rules, the best I can do is to illustrate with a few short examples chosen from the current writings of scientists. I use italics throughout to mark offending words.

THE EXCESS WORD

Nothing makes for more cumbersome, pedantic writing than the use of unnecessary words. For example:

To-day in this country, as nowhere else in the world, we find government unequivocably on the side of the native. *That this is true is undoubtedly due in large measure to the fact that* the Indian is no longer a social or political force to be reckoned with.

The italicized words boil down to "undoubtedly because"; the two sentences become one. Of the fourteen words, twelve are unnecessary. Perhaps even the last phrase, "to be reckoned with," is a bit superfluous, too.

The daily and weekly press supplies most of the reading matter for *many or most* of the world's population *from the high school age to the end of life.*

Better: The daily and weekly press supplies most of the reading matter for the world's adult population.

Many biological processes . . . may be explained by the *influence which* environment *exerts* in furnishing . . .

Improved version: Many biological processes . . . may be explained by the influence of environment in furnishing . . .

Examples *which may be cited that* are familiar *to you* are sunstroke, snow-blindness, and frost-bite.

Revised: Familiar examples are sunstroke, snow-blindness and frost-bite.

For example, in *the* tropical countries *of the world* . . . "Why *of the world?*" the alert reader will ask.

The book is excellent and well adapted to the requirements of superintendents of parks, members of shade tree commissions, and others interested in conserving *those very important resources of the country known as* shade and ornamental trees.

The italicized words add nothing important.

The conception on which it was founded was that there should be provided in Baltimore a place where young scholars attracted from various parts of the country might carry on advanced studies, *particularly with reference to the* development of scholarship and research. [. . . might carry on advanced studies and research.] At the beginning the group was small and the professors were chosen solely *with reference to* [for] the part they might play in this plan.

There seems to be no intrinsic reason why a degree should be given for this study, but the degree has a certain commercial value, particularly *with regard to* [for] those engaged in teaching in secondary schools.

A greater degree of [greater] international cooperation would bring about shifts in the use of land for the production of crops and livestock.

Phrases like *in relation to, with reference to, with regard to, in the case of, a greater degree of* usually mean that the writer has not sufficiently refined his thought. My suggested improvements are in brackets.

IMPERSONAL CONSTRUCTONS AND THE PASSIVE VOICE

Scientists apparently seek to efface themselves or to secure a tone of objectivity by resorting too frequently to impersonal and passive constructions. Example of the impersonal introduction to the main idea by the "There is . . ." or "It is . . ." construction:

With the development of the science of genetics, *there has been a tendency on the part* of writers of text-books . . .

Better: With the development of the science of genetics, writers of text-books have tended . . . The italicized words delay the reader's understanding; the predicate-idea "tendency" comes before the subject-idea "of writers of text-books." The reader has to

make an added judgment in switching the order. Note also that seven fewer words convey the meaning.

Like the impersonal construction, the passive voice too often weakens scientific writing. Usually the active voice makes for a more effectively direct sentence. Too much passive voice in this example from a psychologist's article:

> For instance, a boy may be able to catch a ball, to dodge and to run. Ultimately it will be necessary for him to receive a punt with opposing ends bearing down upon him. In this total situation, account *must be taken* both of the ball and of the approaching ends. If only the ends *are perceived,* he is likely to fumble; if account only of the ball *is taken,* he is likely to be thrown for a loss.

Altered to active voice: . . . Ultimately he may have to receive a punt when opposing ends are bearing down upon him. In this total situation he must take account both of the ball and of the approaching ends. If he is aware only of the ends, he is likely to fumble; if he watches only the ball, he is likely to be thrown for a loss.

The passive voice frequently leads to vagueness. Notice the third sentence in the above excerpt. The words "account must be taken both of the ball and of the approaching ends" arouse the question, "By whom?" "By the boy" or "By the reader" are both good answers. In fact, I happened to take the second answer when I first read the paragraph, feeling that the writer was calling attention to the totality of the situation.

MIXED FIGURES OF SPEECH

I am at a loss to account for the flair that scientists show for figures of speech, a great many of which they use badly. Either they have formed the metaphorical habit, trying as they must so often to see new concepts in terms of the old, or perhaps they feel that their writing requires some sort of "literary" adornment.

> These books put not emphasis but a wet blanket on one or all aspects of the evolution principle; and they often succeed in leaving only a pale ghost of our science in the student's hands.

What legerdemain can cover an aspect of a principle with a wet blanket and produce a pale ghost in a student's hands?

> . . . far more important than important new biological discoveries is now the matter of getting a great many more new *ultimate consumers for the body* of biological knowledge that is already at hand.

"Body of biological knowledge" is a perfectly good expression referring to the close, almost organic integration of biological knowledge. Doubtless a figure of speech originally, the phrase has no longer the force of a figure. When in this particular passage, however, the writer combines "ultimate consumers" with the idea of "body of biological knowlege," the latent, long-forgotten metaphor pops out. And for me at least, appears the picture of a maggot-infested carcass.

> . . . his influence was far-reaching through the activities of a considerable number of his students who were privileged to *bask* in the atmosphere of his enthusiastic leadership.

Bask connotes indolence, certainly not encouraged by enthusiastic leadership. A possible revision: . . . of his students who were privileged to work in the exhilarating atmosphere of his leadership.

> A hundred years of a germ of truth, or seventy-six years since its bloom in publication, has either catalyzed or attended a very wide-ranging body of facts relating worthily to the nature, origin, and destiny of man.

By way of contrast with the above, consider the effectiveness of a complex figure adroitly handled:

> Theory is the scaffolding of science, and just as in ordinary building operations, though some parts of it may be used for a short time before removal, others may function for so long a period that they may well be mistaken for the permanent structure itself.

In the hope that the individual scientist may profit at least slightly, I have called his attention to the most typical of the errors appearing in current scientific writing. In general, all men of science need to be constantly aware of the problems of written communication, since in reality the widest diffusion of scientific knowledge depends upon the written word.

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PHLOEM DEVELOPMENT AND BLOSSOMING[1]

As part of a study of why plants blossom, the idea is being developed that the reproductive state results from a similar physiological condition in different plant varieties, although very unlike or even opposite environments, as long- and short-days, are necessary to induce blossoming. It is being reported that an irregular rate of CO_2 exchange accompanies flowering in contrast to a more regular rate in non-flowering plants.[2] Also, that certain anatomical characteristics

[1] Published with the permission of the director of the Wisconsin Agricultural Experiment Station.

[2] R. H. Roberts, James E. Kraus and Norman Livingston. "CO_2 Exchange Rhythm and Reproduction." To appear in *Jour. Agr. Res.*