# Comments and Communications

## On the Use of Cellulose in Diets

Recent comments by F. Hoelzel and A. J. Carlson (*Science,* December 19, 1947, pp. 616–617) on the practice of adding cellulose to experimental diets at the expense of glucose included remarks pertaining to a paper by us on the growth-promoting action of cellulose in purified diets for chicks (*J. Nutrition,* 1947, 34, 295).

With respect to our paper, we wish to present the following points which Hoelzel and Carlson apparently overlooked:

(1) "Ruffex," a roughage material derived from rice hulls and containing 70% alpha cellulose, was used exclusively in our experiments rather than "Cellu Flour," which is obtained from purified and bleached wood pulp, straw pulp, or cotton fiber (*Conn. agric. exp. Sta. Bull. 127,* 1921, p. 230). The source of cellulose may be a consideration, as preliminary experiments with cotton flock supplemented at the expense of glucose did not give statistically significant increments of growth when compared with chick control groups.

(2) Since the greatest growth response was obtained with just 5% of cellulose rather than with the higher levels, it is hardly conceivable that the results we obtained were due to the very slight increase in the proportion of protein, minerals, fat, or vitamins to the glucose portion of the diet. Ample levels of protein, fat, minerals, and vitamins for the chick were present in the basal ration. Our evidence, in addition, did show that at least part of the cellulose was utilized by the chick.

(3) As Hoelzel and Carlson pointed out, and as is very obvious, the available carbohydrate portion of the ration is reduced when cellulose is fed at the expense of glucose. We were aware of this important consideration and pointed out in our discussion (p. 299) that the "retarded growth and lowered feed efficiency values with the feeding of the 20 percent through 50 percent levels of cellulose were probably caused by a decrease in the availability of metabolizable simple carbohydrates, since the supplements were fed at the expense of glucose." The excellent feed efficiency values obtained with the diets containing the lower levels of cellulose indicate that sufficient utilizable carbohydrate was available (all diets were fed *ad libitum*) in these cases.

(4) That there is also a very real disadvantage in adding cellulose to the complete ration (not at the expense of any nutrient), especially in studying the higher levels, is pointed out by a recent paper by E. F. Adolph (*Amer. J. Physiol.,* 1947, 151, 110). He reported that rats, fed diets in which cellulose and other forms of bulk were added to a complete diet, ingested more bulk but stopped before they ingested a full quota of nutrients. "The limited ability to handle roughage in the alimentary tract then became a factor in the animal's urges to eat."

We feel that the interpretations of the results we obtained were justified from the data given, and that the growth-promoting action of cellulose ("Ruffex"), or its decomposition products, which we obtained with chicks was due to other reasons than the very slightly altered proportion of nutrients in the diet.

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## On Literature Citation

The desirability of references to scientific literature in a published article is not under dispute. There are differences of opinion, however, as to how these should be cited to be of benefit to the reader.

There are three main objects in citing references: (1) to give credit to the original author of a method, theory, process, or other innovation; (2) to tell the reader where to find more information on the subject under discussion; (3) to define the basis of published works on which inferences are drawn. The first of these objects is fully accomplished by citing the author and the location of the original work in scientific literature.

The achievement of the second object depends on circumstances. If the author wants to lead the reader to broader treatment of the point under discussion, he has before him the choice of referring to the abstract which he consulted and found helpful or of citing the original publication, which he may or may not have consulted. Unless the original was studied and is easily available, the reference to the abstract journal should be stated with or without an additional reference to the original.

The reader can easily look up the abstract referred to and then decide whether to proceed further. If he finds a reference only to the original, he has the burden of digging through the abstract indexes to learn what the author has learned and could have presented to the reader at the cost of only the reference entry.

The following incident, which actually occurred, illustrates a questionable practice in presenting bibliographical references. A report was received which, in the bibliography at the end, referred to publications in French, German, Japanese, Russian, Indian, and Polish journals but did not refer to the abstracts of the articles. The apparent implication was that the author read the originals or their translations and based his conclusions on an extensive polylingual study. The reader was not helped much by the bibliography except, perhaps, in judging the basis of statements leading to the conclusions, and thereby the third object of citing references was fulfilled.

In general, it is good practice for the author to refer exactly to the journal which he consulted and not necessarily to the original publication quoted there. Unquestionably, reference to the original can be helpful in spe-

cial cases when, for example, the abstract is too brief or pertinent matter is known to be available in the original which does not appear in abstract.

From the reader's viewpoint, references to abstract journals should be made when they represent the basis of the study. References to originals, then, are optional even if helpful. On the other hand, references to original publications should be made if they are the basis of discussion and conclusions. The references to the abstract journals, then, are optional but still may be helpful. Where space permits, both the abstract entry and the original should be cited.

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## Concerning the Genera of Amebas

In recent literature the nomenclature of certain free-living amebas has been the subject of considerable discussion (S. O. Mast and P. L. Johnson. *Arch. Protistenk*, 1931, **75**, 14–30; A. A. Schaeffer. *Turtox News*, 1937, **16**, 114; 1938, **16**, 96–97; S. O. Mast. *Turtox News*, 1938, **16**, 46–48; Nolan E. Rice. *Biol. Bull.*, 1945, **88**, 139–143; R. G. Short. *Biol. Bull.*, 1946, **90**, 8–18; R. R. Kudo. *J. Morphol.*, 1946, **78**, 317–352; 1947, **80**, 93–143; C. G. Wilber. *Trans. Amer. Mic Soc.*, 1947, **66**, 99–101). The organisms concerned are the following:

(1) *Amoeba proteus* Leidy, also known as *Chaos diffluens*—the common large laboratory ameba.

(2) *Chaos carolinensis* (Wilson), also known as *Amoeba carolinensis, Pelomyxa carolinensis,* and *Chaos chaos*—the well-known "giant ameba" (Schaeffer, 1937; P. F. Brandwein, P. Penn, and C. Schiel. *Science*, 1943, **98**, 431; Kudo, 1946).

(3) *Pelomyxa palustris* Greeff, or *Pelomyxa villosa* Leidy, a less well-known "giant ameba."

Protozoologists who have studied these organisms have no difficulty in distinguishing them from each other and from most other amebas. The confusion is principally in terminology. What should we call organisms 1 and 2? Should organisms 2 and 3 be placed in the same genus? Consideration of these questions leads to the broader question: What are the generic characters of the amebas? The purpose of the present note is to discuss the third one of these questions in the hope of elucidating the answers to the first two.

Schaeffer (Carnegie Instn. Wash., Dept. Marine Biol., Publ. 345, Vol. 24, 1–116), Short, and others have pointed out that organisms 1 and 2 resemble each other in general form. The shape and number of pseudopodia, the ridges on the pseudopodia, and the manner of locomotion are all very similar. For these reasons Schaeffer considered them both to be in one genus, and he designated that genus as *Chaos*. Short, for more or less the same reasons, also considered them to be in the same genus, but decided that the generic name should be *Amoeba*. These two organisms differ in size and in the number and size of nuclei. The first organism has a single large nucleus; the second, several hundred small nuclei. The structure and mitotic behavior of the nuclei, however, are similar in the two species (see Short and Kudo).

Both Mast and Johnson, because of uncertainty concerning the definition of the genus *Chaos*, considered that organism 1 should be in the genus *Amoeba* and that organism 2 should be placed in the genus *Pelomyxa*. Rice considered the differences in size, in number and size of nuclei, number and character of contractile vacuoles, and type of reproduction (binary vs. trinary) sufficient to warrant separate genera and also suggested that the genera be called *Amoeba* and *Pelomyxa*. Kudo arrived at the same conclusion for more or less the same reasons given by Rice.

However, the genus *Pelomyxa*, certainly as represented by the type species, *P. palustris* Greeff 1874, is quite a different animal from organism 2. It is true, as pointed out by Kudo, that both organisms are large and have many nuclei, but in body shape and in the manner of locomotion the two animals are very different. *P. palustris* does not ordinarily form pseudopodia, and certainly it does not locomote by means of pseudopodia.

A very detailed description of *Pelomyxa* is that of Leidy (*U. S. geological survey of the territories*, 1879 Vol. 12), who described *P. villosa*. It is highly probable that *P. villosa* and *P. palustris* are the same species (see Leidy; E. Penard. *Faune rhizopodique du Bassin du Leman*, Geneva, 1902; M. Leiner, *Arch. Protistenk*, 1924, **47**, 253–307; and Kudo, 1946), and Leidy has given an excellent description of the locomotion of this organism. He stated that it is more or less leech- or slug-like in shape, with broader anterior end, and that it progresses through the projection of wave-like or hemispherical expansions of the clear ectoplasm in front and on the sides (when turning). It is very definite in Leidy's description that the organism does not normally locomote by means of pseudopodia but by means of protoplasmic waves. He states: "I have not observed *Pelomyxa villosa* assume the branching condition of *Amoeba proteus*, but under undue pressure I have seen it project one or two digitate pseudopods, as in the latter." The locomotion of *P. villosa* is therefore quite different from that of organism 2, which locomotes by means of pseudopodia, as does organism 1.

The type of locomotion of an ameba is one of its principal taxonomic characters. The generic characters, which are based largely on form and locomotion, have been clearly defined by Schaeffer (Publ. 345), but these have been either ignored entirely or merely mentioned briefly in the more recent literature.

For instance, Wilber's recent paper contains the following quotation from a paper by Calkins (*Trans. 15th int. Congr. Hyg. Demogr.*, 1912, 1–19) which was originally published in 1912, 14 years before the monumental paper by Schaeffer. Calkins said: "The nature of the pseudopodia and ectoplasmic and endoplasmic differentiation are unsafe diagnostic characters by which to identify amoebae, for these have been shown to vary widely in the same species under different conditions of environment." This statement is not valid now, and