parison came to the conclusion that it was a species of *Merychippus*. A more thorough restudy of the Miocene horses last summer brought me to the conclusion that this tooth, while certainly distinct from *Hipparion*, lies somewhere near the border line between *Merychippus* and *Protohippus*, but on which side of the line I can not determine except arbitrarily. The species is, therefore, in fact indeterminate generically, and a valid genus can not be based upon it. *Hippodon* would, however, stand as the type of a group including *Merychippus*, *Protohippus* and *Pliohippus* as contrasted with *Hipparion* and *Neohipparion*. In stratigraphic correlation of the beds at Bijou Hill, where it was found, it would be listed under the Protohippinæ as *Hippodon speciosus* gen. et sp. indet.

3. *Deinodon* Leidy is determinable as to family, but is not determinable generically, as the genera of carnivorous dinosaurs are now distinguished. The same is true of a whole series of genera and species described by Leidy and Cope from the Judith River. The treatment of types and referred specimens of these genera by paleontologists as specifically distinguishable or identical has sadly misled Dr. Peale in his recent discussion of the vertebrate evidence as to the age of the Judith River beds, leading him to present as conclusive evidence of identity in age a correspondence in fauna which to those who know the nature of the specimens on which the lists are based is no evidence at all.

In brief the plea is for the full recognition of nomenclature laws, but for the avoidance of arbitrary or unprovable identifications in the future, and the recognition of the actual facts as to the extent to which described genera and species are truly determinable. The allowed exception in the case of topotypes is based upon an inference of identity which it would seem impossible ever to prove incorrect. In all other cases the chances that future discovery may upset an arbitrary identification should prevent its being used as a basis for changes in nomenclature.

The source of the present lamentable situation in nomenclature is that an excellent system of procedure, designed to settle unsettled questions, has been wrenched from its intent and used to unsettle settled questions. The present writer, having studied with more or less care the majority of the type specimens of American fossil mammals and reptiles, has abundant evidence at his command to upset by a strict application of the accepted laws and procedures, much of the present nomenclature, including many of the alterations proposed in recent years upon grounds of priority. But he has no intention of so misusing his opportunities, or of being responsible for such changes until convinced that they will really result in greater stability.

W. D. Matthew

How is the word food to be defined?

The query expressed in the title "How is the word 'food' to be defined?" is suggested by a restrictive usage of this word which is rather prevalent in American text-books of elementary botany, and which seems to have originated among American plant physiologists. Presumably it had its birth in university courses in botany where the arguments for its use were given and understood, but as it appears in the elementary texts, it involves a marked inconsistency of thought and expression for which no provision is made. Since it represents a striking divergence from the ordinary meaning of the term "food," it deserves wider consideration, looking either toward its general adoption, if desirable, or else toward its discontinuance.

The word food, according to its ordinary connotation, is applied to any substance which, when taken into the body of an organism, can be used by that organism in the construction of new tissue. Definitions of essentially this content are to be found in the Century, Standard and Webster dictionaries. Using this definition as a basis, we should consider as food for green plants the water, carbon dioxide and mineral salts absorbed from the surroundings. According, however, to the restricted usage, these are not considered as "foods," but are referred to as "raw materials," "nutrients," "food materials," or some other cir-

cumlocution. Bergen and Davis[1] have a sentence which shows clearly how the restricted usage conflicts with the general usage illustrated by the definition given above:

> The series of processes by which the plant (1) takes in *raw material* to form its *foods,* (2) unites these into *foods,* and finally (3) constructs tissue from these *foods* or (4) stores them, constitutes nutrition.

Gager in a recent book-review[2] has given another excellent illustration of the same conflict of usages in the sentence which follows:

> On page 38, mineral *nutrients* are erroneously called plant *food.* [The italics of both quotations are mine.]

Judging from these quotations, it is evident that the content of the newer usage is entirely different from the older general usage. Carbon dioxide, water and mineral salts, all clearly to be classed as plant food under the older definitions, can not be so classed according to the newer usage. By a process of exclusion, after a consideration of the quotations just given, we arrive at the following new definition of the word food, viz., *organic materials available for immediate assimilation.* It appears, however, from other discussions that the intentions of the proponents is to apply the term food also to the organic raw material used by animals or colorless plants.

Two questions arise from the foregoing consideration: (1) Why has the new meaning of "food" arisen? (2) Does it deserve to prevail?

The arguments for the restricted usage are derived mainly from a comparison of the nutrition of green plants with that of animals. The food of an animal is chemically practically the same material as the tissues of the animal and consists of proteins, oils, fats and carbohydrates. (Mineral matter may be excluded from the consideration for the present.) During the process of digestion, this food is temporarily simplified as far as may be necessary to make it soluble. Assimilation consists merely in the reconstruction of compounds in general like those found in the original food. In the case of green plants, all the materials obtained from the surroundings are simple inorganic substances. The process of preparing them for assimilation is a complex synthesis, carried on by means of energy derived from an external source. At the end of this process we find ready for assimilation substances of the same sort as those which result from animal digestion. The ensuing process of assimilation is the same in green plants as in animals. These differences and similarities in materials and processes form the basis for the revised definition of the word food.

The reasons for adopting the new definition have been discussed in detail by Barnes.[3] They may be briefly recapitulated as follows: Protoplasm, being the same in green plants as in animals and colorless plants, and the material which it can actually assimilate being always organic, it creates an undesirable antithesis in thought to recognize as food for living things both inorganic and organic substances. Carbon dioxide and water if recognized as food for green plants can be so considered only for the chlorophyl-bearing cells, and for these only in the presence of light. They can not be used as food by the chlorophyl-less cells at any time, or for green cells in the absence of light.

Notwithstanding the weight and authority of the arguments in favor of restricting the meaning of the word food, there are numerous objections which should be given consideration.

One of the principal objections to be noted arises from the fact that the difficulty noted by Barnes and others is mainly of academic interest. So far as I have been able to discover, the question has been discussed only in two treatises of plant physiology designed for use by university students (Barnes and Green). Apparently, then, to be thoroughly conversant with the new usage, it is necessary

[1] "Principles of Botany," p. 106, 1906.

[2] Payne's "Manual of Experimental Botany," *Torreya,* 12: 134.

[3] Coulter, Barnes and Cowles, "Physiology," 3: 356–8.

to have used one of these texts or to have pursued an equivalent course in plant physiology.

Correlated with the objection just noted is another concerned mainly with the teaching of the restricted usage in courses in elementary botany in secondary schools. The clearest approach in beginning a course in botany in a high school lies in leading the pupil to think of plants as separate living things, each of which is an individual, which has, like an animal, its problems of food getting, nourishment, protection, etc. The university concept of the word food, however, requires that the pupil think of a green plant as an aggregate of different kinds of cells which bears a very different relation to its surroundings as regards its food than the living things, *i. e.*, animals, with which the pupil is familiar. The pupil thus loses the definiteness of the idea of a green plant as an individual with problems like those of animals, and has to think of it as something which does not get its food from without, but must manufacture it within its cells. The phraseology of this usage of the word food has been written into the elementary texts without, so far as I have been able to find, any attempt to make the pupil understand how or why it differs from the older usage. As a consequence he learns to use the word food, in the class at least, in a very different way from his ordinary understanding of it, but usually without any realization of the inconsistency.

Complications follow the restriction in meaning which do not appear to have been realized. In the case of green plants food, in the restricted sense, includes only organic material prepared within the cells of the plant and available for assimilation by any of the cells. In the case of animals, food is first, the organic material which, if taken into the alimentary tract, is able to be digested, and second, the material resulting from such digestion, even yet extra-cellular, but comparable with the material recognized as "food" of green plants. Thus it appears that future dictionaries will need to give at least two definitions of the word food.

If we accept the modified definition of food as desirable, we shall then have to face the task of making it part of the common knowledge of all who use the English language. Under present conditions it is practicable to teach it only to the minute proportion who pursue courses in plant physiology in colleges.

Referring to the antithesis in thought to which Barnes objected, it may be noted that this has apparently given little or no trouble to a number of well-known botanists who have discussed plant nutrition in text-books. It appears to have occasioned no difficulty in the elementary texts of Atkinson and McDougal; in the general texts of Bessey, Sachs, Strasburger, etc.; in the physiological treatise of Jost. Ganong in his text-book of physiology refers to the restricted meaning as desirable but as probably impossible to promulgate.

It seems to the writer as entirely unnecessary to attempt to make so great a distinction between the food material of the individual green plant as a whole and the food material of its constituent cells, or between the crude food materials of green plants and animals. It is possible sufficiently to differentiate the materials and their processes of preparation without revising out of conscience the ordinary meaning of an old and useful word. It would appear sufficient to satisfy all the needs of discrimination to use expressions like "crude food" and "cell food." [Since the preceding sentence was written, practically the usage suggested there has been used in high school classes with good results. The use of the expression "cell food" emphasizes to pupils the idea of the cells as the unit of structure and function in living things.]

Finally it may be noted that in the last analysis, it is strictly impossible to restrict the word food wholly to organic material. Barnes limited his discussion of the question to carbon dioxide and water and the carbon compounds resulting therefrom. He expressly excludes mineral salts from his consideration as too small in amount to deserve attention. Logically, however, they can not be excluded even on this basis and especially not in view of the fact that the nitrogen, sulphur and phosphorus of protoplasm are derived from

mineral matter. Moreover, although it is relatively easy to distinguish between CO_2 and H_2O on the one hand as inorganic "food materials," and sugars, starches, etc., on the other hand as manufactured "foods," who can say when nitrogen, sulphur and phosphorus cease to be "food materials" and become "foods"? Is it not more than probable, also, that some constituents of the mineral material taken in by plants and animals are immediately available for assimilation in the form absorbed, and are thus foods in both the restricted and broader senses of the word? If the facts are as here suggested, it is clearly impossible to limit the term food to organic material, first because too little is known of the metabolic processes by which nitrogen, sulphur, phosphorus, et al., are assimilated to enable any one to say at what stage these elements cease to be parts of inorganic and become parts of organic compounds, and second, because some inorganic substances are probably *foods* in both senses of the word.

In conclusion, the question asked in the title may be repeated. How is the word food to be defined? Is it to be limited to organic substances with all the pedagogic and scientific difficulties which such limitation entails? Or shall it remain as at present, raising no practical difficulties whatever and leaving the academic difficulties involved to be dealt with when the pupil becomes sufficiently mature to understand them?

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A STANDARD FORM OF COMMITTEE MEETINGS

DISTANCES in the United States are so great that it is often impossible for a committee to hold a meeting, and its work must be done by correspondence. Owing to the international, or national, character of many committees, and the increasing amount of friendly cooperation among scientific men, some standard system of arriving at results is greatly needed. It would then only be necessary when appointing a committee to state that its work would be done in this way, and the chairman would be saved the necessity of devising a method in each case, and the doubt in many cases, whether he was justified in appending the names of all members to his report.

The following method is accordingly suggested: The chairman or secretary should have three letters manifolded, and sent in due course to each member of the committee. The first of these should state the exact terms of the appointment; the objects desired; a request for suggestions for the report; an opinion whether a meeting is advisable, and if so, when and where.

The second letter should contain a preliminary report embodying the suggestions received, and in cases of doubt asking numbered questions to which, if possible, the answer will be yes, doubtful, disapprove, or no. In the first three cases, the writer accepts the views of the majority of the committee. In all four cases, he authorizes his name to be attached to the report, provided that it contains a statement that he dissents from the questions to which his reply is no. Prompt answers are requested, but if any member fails to reply after a letter has been in his hands for a week, the chairman may assume that he assents.

The third letter should contain the proposed report, to which all the names would be attached unless answers were received expressing dissent. Some of the members might prefer to make a minority report. If no reply was received to letters one and two, letter three should be registered with a request for a receipt, as otherwise the previous letters might not have been received. If haste is important, night letters are generally to be preferred to telegrams, since the delay from the most distant points of the country would seldom exceed twenty-four hours. If a reply by cable is necessary, the chairman should give his cable address, and if possible arrange all his questions so that each answer shall consist of only one or two words. A reply by cable, in which the fifth question related to a place of meeting, might read: Fieldsmith, Washington. One, two, yes; three, no; four, doubtful; five, London, July. Brown.

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