THE NEED OF STUDIES OF THE MINERAL NUTRIENT CONTENTS OF FOODS AND FEEDS

THE subcommittee on animal nutrition of the National Research Council wishes to call to the attention of research workers in nutrition the need for further extensive information—which should be readily obtainable—on the mineral nutrients of foods and feeds.

The fundamental importance of the mineral elements in nutrition being universally understood, as also many details of their more obvious functions, much progress remains yet to be made especially in the understanding of their complex interactions, their relations to the vitamins, and their metabolism in tuberculosis, anemia, pellagra, rachitis, caries and the various types of rheumatic disorder.

While animal experimentation in this field must deal primarily with pure compounds the study of dietetic relations calls for a much broader and more detailed knowledge than we now possess of the quantitative presence of mineral nutrients and of the causes of variations in the contents of mineral nutrients, in human foods and animal feeds.

It is well known that the mineral nutrient constituents of the leaves and stems of plants vary widely in response to conditions of growth, such as relating to soil and climate; and even the seeds and fruits of plants vary significantly in these regards, though less prominently than do leaves and stems.

In the light of these facts we believe that the mineral nutrients of each agricultural crop, each food and each feed should be studied in extensive series of samples selected to represent significant environmental conditions or methods of preparation; and it is especially to be desired that such analyses should cover not only the organic nutrients, and those inorganic elements ordinarily considered as nutrients —namely, sodium, potassium, calcium, magnesium, sulphur, phosphorus, chlorine, iodine and iron, but also those others the functions or effects of which are much less perfectly known—namely, manganese, fluorine, bromine, silicon, boron, aluminium, copper, arsenic and zinc.

It is the hope of the committee that studies of soil fertility and of plant and animal nutrition may be so expanded as to yield information of the kinds specified and that new researches may be undertaken for the specific purpose of bringing forth the knowledge desired.

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ENGLISH VS. METRIC SYSTEM

I REGRET that Professor Gortner (SCIENCE, February 11, 1927, p. 163) should take exception to the use of the term a "quarter of wheat" in the paper by Mr. Williams and myself but I am quite unrepentant.

While I heartily agree with him as to the merits of the metric system and the unscientific basis of the English system of weights and measures, the fact remains that the latter system is still in general use in this country for all except scientific purposes. The *scientific data* in papers published in scientific journals should be, and usually are, given in metric units, and our paper is no exception to this. The sentence which Professor Gortner quotes deals with information which is not scientific, but agricultural; since in the art of agriculture the unscientific British system of weights and measures is still in use, it is necessary to give such information in language which is readily intelligible to those familiar with Briitsh agricultural conditions. It is primarily for such that this information was intended, and had the usual yield of wheat from this land been stated in say metric quintals per hectare, or even in hundredweights per acre, the British reader would have had to calculate back into quarters or bushels per acre, since he is accustomed to think of the yielding capacity of agricultural land in terms of the units of yield used by the farmer. It is true that this puts the foreign reader at a disadvantage, but he can readily convert into metric units if he consults a suitable authority.

Here I must parry the charge of writing in an unscientific manner, which is implied in Professor Gortner's remarks, by suggesting that in seeking for the sense in which we used the word "quarter," he himself has not proceeded as scientifically as might have been expected from a scientist of his distinction, "to whom English is the native language, and who has been brought up to use the English system of weights and measures." If he had consulted Webster's New International Dictionary, a standard work of reference produced under American editorship, he would have found the definition: "Eight bushels, the fourth of a ton, used especially in measuring grain." Consultation of the "Encyclopaedia Britannica," 10th Edition, Vol. 22, p. 713 would similarly have yielded the definition: "as a measure of capacity for grain it measures eight bushels." The quarter, and the bushel, are of course primarily measures of volume, and the weight of a measured bushel varies with the kind of grain, and with different samples of the same grain; Webster's parenthesis "the fourth of a ton" is not strictly accurate. For conversion to weights of wheat an arbitrary average factor must be used,

but by reference to Vol. I of the same work, under the heading "acreage and yields of British crops" in the articles on Agriculture, p. 398, is found the definition: "per imperial quarter, that is, 480 lbs. of wheat"; the imperial bushel is the same as that in use in the United States, 60 lb. of wheat.

Finally the International Institute of Agriculture of Rome, of which one function is that of coordinating and distributing agricultural information, has published a useful book: "Recueil de Coefficients et d'Equivalences" (4th Edition, 1922) in which are given the metric equivalents of the weights and measures of all countries. Here, on pp. 30 and 31 we find "quarter = 8 bushels = 2.90942 hl" and "1 Quarter froment = 480 liures = 2.17724 q."

Thus, despite the inconvenience caused by the failure of this country, as well as the United States, to adopt the metric system of weights and measures, there is no special difficulty in defining a quarter, and in converting it to metric units, if the source of reference is chosen with due regard to the context in which the term is used.

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THE LOGARITHMS OF NAPIER

READERS who have not consulted the original writings of John Napier will be misled by an article by Professor G. A. Miller in the Proceedings of the National Academy of Sciences, September, 1926, p. 537, denying the accuracy of the equation,

$$\text{Nap. log } x = 10^7 \log_e \frac{10^7}{x},$$

to explain the relation existing between the logarithms invented by Napier and the natural logarithms. We read:

> The inaccuracy of this equation, according to later historical studies relating to logarithms, results directly from the striking and well known theorem that the only pair of algebraic numbers which satisfies the equation $y = e^x$ is $x = 0$, $y = 1$. The tables which Napier computed imply that the rational integral numbers listed therein have rational integral logarithms, according to his use of this term. It is, therefore, obvious that no general exact rational relation can possibly exist between these so-called logarithms and those of base e, since Napier did not consider any operation leading to transcendental numbers. The fact that the given equation is approximately true is of secondary interest.

The tables of Napier represent in general only approximate values, as do all logarithmic tables. But the fundamental theory, as found both in his "Descriptio" and in the body of his "Constructio," leads to a "general exact rational relation" between his logarithms and those of base e, and involves transcendental numbers. Napier's conception of logarithms is kinematic and based on continuity. Napier uses expressions, such as, points "travel," "distances traversed in equal times," "ducenda sit linea fluxu . . . puncti," which can not be successfully interpreted without admitting continuity. We quote from the "Constructio" (§§ 25, 26) the specification for his "geometrically moving point" and his definition of "logarithm":

> A geometrically moving point approaching a fixed one has its velocities proportionate to its distances from the fixed one.
>
> The logarithm of a given sine is that number which has increased arithmetically with the same velocity throughout as that with which radius began to decrease geometrically, and in the same time as radius has decreased to the given sine.

Logarithms are here defined by the *velocities* of two points, and it is easy by aid of the calculus to derive, rigorously, the above equation, as is done in my "History of Mathematics" (2d ed., p. 150). Napier uses such phrases as "incommensurable number," "*bc*, the logarithm of the sine *dS*" (*bc* and *dS* being line segments), "the logarithm which *bc* represents," logarithms "may be included between near limits." These and Napier's mode of deriving his theorem on limits, and his fundamental theorem, "logarithms of proportional numbers or quantities are equally differing," make it very evident that, in the presentation of his theory, Napier looked upon logarithms as exact values deduced from the above kinematic definition of a logarithm.

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AN UNAUTHORIZED REPRINT

I should feel grateful, if you will permit me through your columns to draw attention to the issue in the United States without my permission of a reprint of my "Grammar of Science." That work without revision is hopelessly out of date, and it is not only an injury to the author but an insult, if it leads any purchaser to suppose that the treatment of the subject in 1911 is an adequate criticism of the state of physical science in 1927, and represents the present views of the writer.

Morality in such matters appears to differ very widely on the two sides of the Atlantic. I can only sympathize with a well-known British author who on seeing a multinational publisher enter a club-room remarked to me: "Now Barabas was a publisher."

KARL PEARSON