sufficiently close to the thinking which underlies scientific advance. No good can come from excluding them from the operation of a scientific organization. This bill attempts to legislate into existence a profoundly disturbing set of administrative devices.

A bill, in order to be acceptable, should contain as a minimum, the following provisions:

A *Constituent Assembly* should be called by the President, consisting of representatives, selected by the President, from the various forms of institutions of learning, colleges and universities, research institutes, industrial laboratories, and government services, lay and military, existing throughout the country.

Recommendations to the President should issue from the deliberations of this Assembly and its appropriate functional committees, including primarily nominations to a responsible Board of Directors.

The *Board of Directors* should be appointed by the President from among the nominees, with the consent and advice of the Senate. This Board should have the powers usually exercised by such Boards in nonprofit membership corporations. The Members of this Board should devote as much time to the Corporation as may be necessary to its proper functioning and the carrying out of its objectives. The Board should formulate its own rules of procedure. The Board should be responsible at all times to the "Scientific People," represented in an Assembly of Members, which should succeed to the authority of the Constituent Assembly.

The *functions of the Board should include*:

(1) Carrying out the policies of the Corporation.

(2) Recommending to the President, for his choice, candidates to serve as Administrator. The Administrator should be responsible to the Board and see to carrying out the purposes of the Corporation.

(3) Appointing the Members of the Scientific Committees, on the advice of the Administrator, the Committees appointing their own Chairmen.

(4) Making appropriations and grants and appointing fellows and scholars on the recommendation of the Scientific Committees, and in accordance with regulations made by the Board, with the advice of the Scientific Committees.

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The Amino Acid Composition of Proteins and Foods

H. B. Vickery and H. T. Clarke (*Science*, 1945, **102**, 454–456) have questioned the practice of computing the results of amino acid determinations upon a uniform basis as employed in our monograph (*The amino acid composition of proteins and foods.* Springfield, Ill.: C. C. Thomas, 1945).

Four or five years ago, when contemplating the writing of this monograph, the various methods for presenting amino acid data were discussed with a number of workers in the protein field. The easiest method, from the authors' point of view, would have been to copy the data in the literature and to present the figures as per cents by weight of substance analyzed in some cases, as amino acid nitrogen in per cent of total nitrogen in others, or as per cent by weight corrected for "moisture" and "ash" in others, etc. A second method would have been to calculate all the data as amino acid nitrogen in per cent of total N. Although this procedure is useful for many purposes, we did not consider it as suitable for a monograph designed primarily for food chemists. A third method, used by Murrill, *et al.* (*J. biol. Chem.*, 1940, **133**, 521), appeared to be most suitable for our objectives.

How intelligible would the first procedure be to the average person whom we believed would use this monograph? It would impose a considerable burden on those who wished to compare the results by a number of investigators on the same protein. For example, amino acid values of casein may be given by one investigator as per cent of a sample of commercial casein as analyzed (N = 13.6 per cent); by another, as per cent of the casein corrected for "moisture" and "ash" (N = 14.9 per cent); a third author may hydrolyze a sample of casein and then calculate the quantity of "pure" casein used from a nitrogen determination on the hydrolysate, taking 15.7 as the per cent of nitrogen in casein; etc.

In order to facilitate comparison of analytical data on the same protein by different investigators, we chose an extension of the third method of presentation, namely, calculation of all values to 16 per cent of N. In an attempt to prevent any misunderstanding of our purpose, the original nitrogen values upon which the calculations rested are presented in all except a very few instances, and even in these cases the reasons are explained in the text. Furthermore, repeated examples of how the data in the tables are to be used are given. For instance, on pages x and xi of the Introduction we say: "As all the data in the tables are calculated on the basis of 16 percent of nitrogen, it is only necessary to know the nitrogen content of the protein in order to calculate the data in the tables to give the approximate amino acid composition of the preparation. If the protein contains 18.6 percent of nitrogen on a moisture and ash free basis, then the values in the proper table are multiplied by the factor $\frac{18.6}{16.0} = 1.16$." Other examples are also given here and throughout.

This type of presentation was repeatedly tested before publication by presenting papers containing these calculations at protein symposia such as the American Chemical Society at Cleveland, the Cereal Chemists Meeting at Minneapolis, the Gibson Island Conferences, and a half dozen other meetings and seminars, as well as by the distribution of much of the data to government agencies and groups interested in food chemistry. At no time was any adverse criticism made of the manner of presentation.

Our monograph was designed primarily to present to the food chemist the widely scattered literature on the methods and results of protein analysis in the most useful and practical form. We have sincere doubts concern-

ing the advisability of presenting original data only in this type of monograph. While, if each table had been devised on the basis of a currently accepted value of nitrogen of a pure protein, then it would have been incumbent on the food chemist to make the conversion to the factor he was using for estimating the protein content of the diet. The factor is almost always 6.25. We felt that the protein chemist was equally prepared to perform the reverse calculation. It is quite true that many arguments against this practice may be presented, including those stated many years ago by Kossel, the venerable nature of whose views does not necessarily impart increasing force. The fact remains that "N × 6.25" is not only almost universal, but it is incorporated into the food and feed laws of almost every state in the Union. Almquist (Nutritional Conference, Oregon State College, March 1945) said in this connection: "While it has been shown that this conversion factor differs from 6.25 for certain single foodstuffs, the fact that they are ultimately mixed and accounted for in prepared feeds on the basis of a 6.25 protein factor is ample justification for retaining this factor."

Although we used the N × 6.25 calculation in this monograph, we repeatedly mentioned its limitations and certainly did not advocate it as a general practice in protein chemistry. In fact, in two tables on the amino acid composition of selected plant and animal proteins, prepared by one of us for a recent textbook (Kleiner's *Human biochemistry.* St. Louis: C. V. Mosby, 1945), only the industrially important corn gluten, wheat gluten, soybean proteins, and yeast proteins are calculated to 16.0 per cent of nitrogen. The remaining 14 proteins, being considered purified products, are given on the basis of the best available nitrogen values.

Thus, the so-called calculation error is nullified when the amino acid values are employed in the manner which we designated. However, because the amino acid data could be misconstrued, in spite of the precautions taken, we contemplate presenting the data in the forthcoming revision of this monograph as grams of amino acids per 16 grams of nitrogen in the sample. It is hardly necessary to point out that the actual values given and the mode of calculation to purified proteins or crude foodstuffs remains unchanged.

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Amino Acids in Food Materials

R. J. Block and D. Bolling's recent publication (*The amino acid composition of proteins and foods.* Springfield, Ill.: Charles C. Thomas, 1945) contains 14 tables presenting the amino acid content of a variety of "pure" and mixed proteins from animal and plant sources. The percentage of amino acids in these proteins is uniformly calculated from an assumed 16 per cent of nitrogen in each protein. Of course, the usual procedure was followed of determining the nitrogen in the material to be examined and then multiplying by 6.25 for conversion to protein.

This procedure of stating the amino acid content of the protein has recently been sharply criticized by H. B. Vickery and H. T. Clarke (*Science,* 1945, 102, 454–456). They argue that since the nitrogen conversion factor for casein, edestin, and a very limited number of proteins is known, such factors should have been used and not a uniform factor based on 16 per cent of the nitrogen in the protein. Surely they are correct in insisting that the nitrogen-to-protein conversion factor, when definitely known, should be used. But, how many proteins, with known nitrogen content, have been isolated in a sufficiently pure state to make possible the erection of extensive tables on the amino acid content of proteins or foods? Not many, as compared with the number of foods and feeds.

In nutrition we are interested in the amino acid distribution in the foodstuff itself, such as wheat, meat, milk, eggs, etc., and not in the amino acid content of a single protein constituent of the foodstuff, except for fundamental studies in protein chemistry.

Consequently, Block and Bolling could do little else than follow the method they used, especially since they included in the tables such complex protein mixtures as tankage, meat scraps, fish meal, feathers, liver, grass, yeast, oats, linseed meal, etc. There are no accurate or even proposed conversion factors for such complex protein mixtures.

Historically, Armsby once proposed the term "true protein" of feeding materials for the basis of determining the protein requirement of animals. He did this because it was known that there existed in plant materials considerable unorganized nitrogen, assumed to be of non-nutritive value. The Agricultural Chemist measured the "true protein" of a feeding material, by the use of Stutzer's reagent, a copper compound supposedly effective as a precipitant of all protein nitrogen. Such a procedure is no longer followed. Yet, if one converts the nitrogen of an alfalfa hay to protein by the use of the conventional factor of 6.25, he must realize the gross error involved. There is no conversion factor for nitrogen to protein in food materials that is at all uniformly or even approximately reliable.

With this situation, what can be done? Adopt the plan of expressing the amino acids of a food or a feed material as per cent (1) of the dry material or (2) of the dry, fat-free material. We do this today for many constituents such as calcium, magnesium, etc. No attempt is made to express such constituents as per cent of the ash or of the complexes in which they exist. Use the weight of the free amino acid and not the anhydride. When the amino acid content of a food is expressed on the dry basis, it would be desirable to have the analysis accompanied by the amount of fat in the sample, especially for those products such as meat, where the fat content is extremely variable. These are the preferred methods. Or, (3) express the amino acids of a food or a feedstuff as per cent of the total nitrogen. either