is recognized as the structural element in the cell on which growth and reproduction depend, attention was naturally directed to nuclear derivatives, and it was found that the reciprocal of the bactericidal curve matches the absorption curves for certain derivatives of the nucleoproteins—cytosine, thymine and uracil—more closely than it does those for various aromatic amino acids, such as tyrosine, tryptophane or phenylalanine, suggested by Harris and Hoyt.

The close reciprocal correspondence between the curve of bactericidal action and the curves of absorption of ultra-violet energy by these nuclear derivatives not only promotes the probability that a single reaction is involved in the lethal action of ultra-violet light, but has a wider significance in pointing to these substances as essential elements in growth and reproduction. This conclusion is in harmony with the observations of other writers. Thus, Murphy, Helmer and Sturm,[2] by electrodialysis, have effected a marked concentration of the active agent in transplantable tumors of fowls. The material which, as they are careful to say, "carries" the active agent, appears to be a nucleoprotein, and gives "a uniform Feulgen reaction[3] of the so-called thymonucleic acid group."

And now Cowdry[4] has applied the Feulgen reaction to tissue cultures of normal fibroblasts and of various sarcomata, and finds that under these experimental conditions the nuclei of both rat and chicken sarcomata are much richer in the substance giving the Feulgen reaction—presumably thymonucleic acid. Cowdry also studied various neoplastic tissues obtained from mice in comparison with normal tissues similarly stained. As was to be expected, "the thymus gland always gave a more pronounced Feulgen reaction than the tumors," but in the other fragments of tissue "the nuclei of the tumor cells were more strongly stained so that the extent of the neoplasms could be readily seen by naked-eye inspection of the slides." Under the microscope, however, this difference between the nuclei of tumor cells and of normal cells could not be made out, and Cowdry does not attempt an explanation of the discrepancy between the results obtained in tissue cultures and those obtained with excised material.

Thus, while the relation of thymonucleic acid to cell growth and reproduction remains a matter of conjecture, nevertheless its high concentration in the thymus gland and the coincidence of the evidence from these three independent series of experiments seem worthy of note, without further comment at present.

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[2] J. B. Murphy, O. M. Helmer and E. Sturm, SCIENCE, 1928, N.S. 68: 18.

[3] R. Krause, *Enzyk. f. Mikr. Tech.*, 1927, 3: 1729.

[4] E. V. Cowdry, SCIENCE, 1928, N.S. 68: 138.

NOMENCLATURE OF THE ACCESSORY FOOD FACTORS

THE science of chemistry, broad in scope and voluminous in terminology, requires that the names by which substances are known shall be chemically correct and indicative of certain class relationships between compounds. To this end there has grown up the custom of indicating the chemical structure of compounds in the first part of the name applied thereto and of showing class relationships by a similarity in the ending of the name. Examples of this are too numerous and familiar to require mention here. What is true for the entire body of chemistry is correct to an equal degree for the divisions thereof and should apply likewise to related fields.

At the present time there is a cycle of confusion in the field of nutritional chemistry because of failure to apply the principles mentioned above. The fact that this failure has been, in part at least, unavoidable does not alleviate the difficulty and the rapidity with which research is moving forward makes very necessary the adoption of a more suitable system of naming the known accessory food factors, the so-called "vitamins."

Funk[1] in 1913 applied the term *vitamine* to a group of nutrient principles, then only two in number, the existence and necessity of which had been previously proven. This term, as Funk used it, meant literally substances associated with life processes and chemically closely related to the amines, inasmuch as Funk believed them to be amine-like in structure. This theory, unfortunately for present-day terminology, has not been borne out and it was long ago recognized, as pointed out by McCarrison,[2] that the name *vitamine* was a misnomer. In fact the abridgement of the term *vitamine* to *vitamin*, while in accordance with the policy of the Chemical Society (England) and conforming to the American method of naming the hormones, was a tacit admission of the incorrectness of Funk's terminology.

The proposal of McCollum and Kennedy[3] in 1916, that the two "vitamins" known at that time be desig-

[1] C. Funk, "Die Vitamine," Wiesbaden, 1913.

[2] McCarrison, Robert, "Studies in Deficiency Disease," Oxford Med. Public., 1921.

[3] E. V. McCollum and Cornelia Kennedy, "The Dietary Factors Operating in the Production of Polyneuritis," *J. Biol. Chem.*, 1916, xxiv, 491.

nated by a letter and a prefix denoting characteristic solubility, was widely adopted. With the proof of the existence of other factors of similar nature this method has been extended and the "vitamins" lettered alphabetically in the order of their discovery.

The appellation "Fat-soluble A," "Water-soluble C," etc., not only implies nothing concerning the relationship between the nutrient principle in question and the pathological condition occurring in man and animals in its absence, but is in addition too limited in its implied meaning, and while perhaps adequate for the period when only two or three accessory factors were known it has become somewhat confusing with the added designation of newly discovered factors. Moreover, with the separation of one of the original factors into two component parts certain hitherto unforeseen complications arise.

If the suggestion of Hunt[4] and others be followed, namely, that one fraction of the hitherto designated "vitamin B" be termed "vitamin F" and the second fraction "vitamin G," then "vitamin B" ceases to exist in its original sense, and there is a break in the alphabetical sequence of designation. Of more consequence than the mere disruption of the alphabetical method of naming, however, is the fact that great confusion is introduced into extant "vitamin" literature. The suggestion of Chick and Roscoe[5] that the term "vitamin B" be retained for one fraction is not only incorrect from previous standpoints, but will lead to difficulties—difficulties which will be augmented if the "vitamin B" complex is further fractionated. Moreover, the above suggestions are not universal, certain writers using different designations. Added to this is the possibility, not entirely remote, that "vitamin A" may eventually give way to H and I, that "vitamin C" may lose its existence in giving birth to K and L, etc. The resultant confusion need only be suggested.

In justice to existing terminology and the efforts of those who established it it must be said that certain difficulties peculiar to this branch of chemistry stand in the way of following the orthodox method of naming chemical entities. Chief among these obstacles is the fact that the chemical constitution of these substances, with one possible exception, is unknown. The characteristic effects accompanying the absence of "vitamins" from the diet of man and certain animals (the syndromes of the deficiency diseases) is known, however, and based upon this fact the author has evolved a system of naming which it is hoped will be of some value.

According to this plan the generally accepted term *vitamin* would be discarded and the name *advitant* substituted therefor in accordance with the recommendation of McCarrison.[6] This step is believed desirable in order to eliminate the ending *amin*, which is a meaningless hangover, while retaining the term *vita* to indicate the close association of these substances with life processes. Then, in place of an alphabetical designation of the accessory food factors, each would be designated by a prefix in accordance with the disease for which it is preventive, and the suffix *amin* would be *provisionally* retained for all until such time as the chemical structure of the substance was established. With the chemical structure known the ending *amin* could be replaced by one denoting the chemical relationship.

Accepting for the moment the recent work which indicates that "vitamin D" is irradicated ergosterol, an example will be given to show how the nomenclature herein recommended would work out. The antirachitic factor would be termed an *advitant* and provisionally designated as *rachitamin*. Granted that its identity as an activated sterol was established, the suffix *amin* would be replaced by the term *sterol*, making the permanent name *rachitasterol*.

The provisional names suggested for the vitamins now known and the relation of these names to those now in use are given below in tabular form:

TABLE I

Group name	Generally accepted name	Suggested provisional name	Possible permanent name
Advitant	Vitamin A or Fat-soluble A	Ophthalamin	
	Vitamin B or Water-soluble B	Polyneuramin Pellagramin	
	Vitamin C or Water-soluble C	Scorbutamin	
	Vitamin D	Rachitamin	Rachitasterol
	Vitamin E	Sterilamin	

While realizing the limitations of the nomenclature given above the author believes that the names suggested not only indicate the relationship between the accessory food factors and the deficiency diseases effected in their absence, but that they offer a means of stabilizing the present confusion, at the same time providing for future expansion and correction.

ROBERT L. JONES

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[4] Charles H. Hunt, "The Complex Nature of Vitamin B as found in Wheat and Corn," *J. Biol. Chem.*, 1928, lxxviii, 83.

[5] Hariette Chick and Margaret H. Roscoe, "On the Composite Nature of the Water-soluble B vitamin," *Biochem. J.*, 1926, xxi, 698.

[6] *Loc. cit.*