tion with the Bureau of Economic Geology as consulting geologist.

DR. KARL FRIEDERICHS, professor of applied entomology in the University of Rostock, has been called to the University of Minnesota.

DISCUSSION AND CORRESPONDENCE

THE MEANING OF VITAMIN A

A RECENT discussion in these columns of the nomenclature of the "accessory food factors" commonly called vitamins[1] suggests for these substances a new set of provisional names, each to be distinguished by a prefix "in accordance with the disease for which it is preventive." Strongly as we sympathize with the desire to prevent further confusion, we are unable to believe that that laudable purpose would be advanced by this suggestion. The vitamins, while not yet chemically identified, are apprehended as chemical individuals to each of which in due time will presumably be assigned a name descriptive of its chemical nature. Meantime the nutritional significances of these substances are being studied, and as the knowledge of each has separately been advanced by experimental investigation, increasing emphasis has been laid upon its rôle in normal nutrition. In dealing with substances which are presumably chemical individuals and are certainly essential nutrients, it seems distinctly preferable to avoid or minimize the use of designations characterized by what the British Committee has aptly called "pharmacological bias."

The alphabetical designations of the vitamins, while admittedly colorless, have the very great advantages of freedom from such bias and from connotations inconsistent with anything which may be learned by further study of these substances. Under the noncommittal designation of a mere letter, our knowledge of any vitamin may grow in any direction without the development of inconsistency between the designation of the substance and its more newly discovered properties, and without the development of a situation in which the name would appear to put the emphasis in the wrong place. Without further elaboration in general terms, this may be illustrated by the case of vitamin A.

Vitamin A is a normal nutrient. It is essential to growth in the young; and it is essential to normal nutrition and health at all ages. Lack of vitamin A results in a widespread weakening of the tissues of the body and of its ability to resist infections. An early and frequent manifestation has been the development of an ophthalmia. This has occurred so regularly (at least in the experience of most observers) as to be rightly regarded as a fairly characteristic result of a lack of vitamin A. But it is only one of several results, and probably not the most important; for further studies have shown that the same nutritional deficiency which gives rise to the increased susceptibility to this eye trouble results also in an increased incidence of respiratory disease (probably a matter of greater actual significance, even if less readily adapted to experimental demonstration); of skin, ear and sinus infections; of inflammations and infections of the alimentary tract; and even of renal calculi. That like deficiencies of vitamin A in the food are not always followed by like effects is largely due to the important degree to which this substance may be stored in the body; and this in turn again emphasizes its rôle as a normal nutrient. Thus in a recent series of experiments young rats were taken at the same age from families of the same hereditary stock but which had been fed on different diets, one richer than the other in vitamin A but both within the range of the normal in this as in other respects. All were then subjected to the same experimental régime involving first a period of deprivation of vitamin A until the body no longer contained a surplus store of this nutrient and then a longer period during which only a fixed limited allowance was fed. Afterward all were killed and examined for plain evidence of infection. Notwithstanding the relatively long period during which all had received the same diet, it was found that resistance to infection was still greatly superior among those which in their very early lives had received the more liberal allowance of vitamin A. Taking account of the relative lengths of the rat and the human life cycles, and the similarity of nutrition in the two species, this is an indication of the differences of incidence of infection to be expected among children of around ten and twelve years, resulting from differences in the way they were fed before they were three years old. In terms of articles of food, it was a higher proportion of milk in the diet which here conferred the higher degree of health as manifested by increased ability to resist disease; and in chemical terms, vitamin A was one of the significant factors. The significance of vitamin A for general health and stamina has also been clearly shown in other ways. Experimental animals alike in all other respects and fed different allowances of vitamin A may show differences either early or late according to the extent of the dietary deficiency and the differing opportunities which had been afforded the animals to acquire a bodily store in advance of the period of dietary deprivation. But even when the differing dietary allowance of vitamin A did not produce obvious effects

[1] Robert L. Jones, "Nomenclature of the Accessory Food Factors," SCIENCE, 68: 480, 1928.

during the period of growth, the effects upon later life were very pronounced and showed that a liberal intake of vitamin A has a most important bearing upon the length of life and upon the general stamina of the adult as reflected in ability to resist disease and to produce and rear healthy offspring.

Thus our growing knowledge of vitamin A gives it a meaning very much broader than merely that of a substance which prevents an eye disease. While the relation to ophthalmia is well worth remembering, yet there now seems certainly to be a still greater significance in the effects of vitamin A in increasing resistance to respiratory disease and in contributing to the condition of general health and vigor, both in the individual and in successive generations.

To suggest the habitual use of any such term as "antiophthalmic vitamin" or "ophthalamin" seems, therefore, probably to put the emphasis in the wrong place, and certainly to be unfortunate in that it diverts attention to but a small part of the true meaning of vitamin A.

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THE SIEVE OF ERATOSTHENES

IN SCIENCE for September 21 (p. 273) a writer directs attention to the alleged "widespread error" of attributing to Eratosthenes the "sieve" for finding all the prime numbers which do not exceed a given number. The writer claims that the method was known long before the time of Eratosthenes, but does not state on what evidence his statement rests. He simply gives the information as a well-established fact and directs the reader to E. Hoppe's "Mathematik und Astronomie," 1911, p. 284. Consulting Hoppe one meets with the statement that the method is found in Plato's "Phaedo," chap. 52, and that Plato also proved the number of primes to be infinite, a proof usually ascribed to Euclid. *If true,* these statements are important and deserve to be published in a widely read periodical like SCIENCE. But are they true?

Hoppe's statement has not been fully accepted by any historian of mathematics. Plato in "Phaedo" speaks of hot and cold, fire and snow, as necessarily excluding each other. Likewise the idea of odd and the idea of three and of five are opposite to the idea of even and of two. They reciprocally exclude each other, as indeed do the immortal soul and death. This is not the place for extensive quotation from Plato. It is sufficient to say that it is not clear that Plato considers here prime numbers at all, as a class. The late G. Eneström, the very ablest recent critic in the field of mathematical history, printed in his journal a review by G. Junge who expresses himself on this matter as follows ("Bibliotheca mathematica," XII, 1911–1912, p. 356): "Mr. Hoppe is not at his best when he purports to discover in Plato's writings all sorts of mathematical results which no one before him has yet found in them and which probably no one will find in them again. Thus he claims (p. 284) that the sieve method of Eratosthenes is 'already fully developed by Plato' and that the theorem that the number of primes is infinite is found in Plato." No further comment on our part is necessary.

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THE PROBABLE USEFULNESS OF BLOOD-GROUPING TESTS IN ESTABLISHING NON-PATERNITY

IN connection with bastardy proceedings it is desirable that the defendant may know the chances of establishing his innocence by comparing his isohemagglutination group with that of the mother and of the alleged offspring.

We have calculated the probabilities which obtain among the white population of the United States. Details of the method will shortly be published elsewhere. The results, based upon the inheritance hypothesis of Bernstein, are as follows:

PROBABILITIES OF ESTABLISHING NON-PATERNITY WHEN ONLY THE WRONGFULLY ACCUSED MAN'S BLOOD GROUP IS KNOWN

Landsteiner	Group Jansky	Moss	Probabilities
0	1	4	1/5
A	2	2	1/17
B	3	3	1/7
AB	4	1	1/2
Unknown			1/7

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PRESSURE PHENOMENA IN THE DIVIDING CELL

MOTION photography reveals phenomena which do not register upon the physiological eye. Just as the microscope alters space dimensions, so may the motion camera accommodate time dimensions to a scale of normal interpretation, and thereby draw closer the relation of morphology to physiology. Evidence has, for example, been obtained by this instrument, which demonstrates the existence of defi-