and Brownian movement. This was followed by irregular linear distortion beginning at the central pallor and ending in incomplete red cell fragmentation.

These observations may be significant in further demonstrating the differences between the globin fractions of normal and sickle cell hemoglobins. It is now believed that Heinz bodies represent particles of denatured globin ("globan") (*1*). If so, their formation under the above conditions indicates a denaturing effect by the bisulfite on the intraerythrocytic globin. It has been assumed that the principal difference between normal and sickle cell globins lies in the folding or coiling of the polypeptide chains of the globin molecules (*2*). If this is so, it is conceivable that certain reactive groups (possibly —SH) in the normal globin molecule are available for combination with bisulfite (and subsequent denaturation of the globin), whereas the different molecular arrangement of the sickle cell globin does not lend itself to this reaction. Studies are now in progress to observe the effect of other reducing agents on this phenomenon and to determine whether quantitative differences are present in the reaction of erythrocytes from patients with sickle cell anemia as compared to those with the sickle cell trait.

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Who Discovered Vitamins?

EVERY writer who has given an account of the earliest conception that essential nutrients for mammals, other than the "albuminous, saccharine, and oleaginous principles" comprehended in 1827 by Prout, states that N. Lunn (*1*) in 1880, while working in the laboratory of G. v. Bunge, at Dorpat, was the first to provide proof that unidentified dietary essentials must exist in milk. The basis for Lunin's statement was his observation that mice could remain in good health during at least 60 days when restricted to milk as their sole food, whereas, when given a mixture of casein, lactose, milk fat, and milk ash, in the same proportions as in milk, they speedily declined and died. He wrote: "Mice can live well under these conditions when receiving suitable food (e.g., milk), but as the experiments show that they cannot subsist on proteins, fats and carbohydrates, salts and water, it follows that other substances indispensable for nutrition must be present in milk besides casein, lactose, fat and salts."

The present writer believes that the first person actually to express this belief was the distinguished French chemist, J. A. B. Dumas. Ten years before Lunin wrote the statement quoted above, Dumas published a paper on "The Constitution of Blood and Milk," which was published in English translation in 1871 (*2*). In this paper he described the effects of substitute foods on the infants of Paris during the Siege. Here, for the first time in history, a distinguished scientist interpreted his observations on the experiences of human subjects, restricted through the pressure arising from the siege, to a diet as simplified, in chemical terms, as any rigidly controlled animal experiment. Dumas told of the extremity of the people in Paris when they ran out of "comestibles and combustibles." He said ". . . to the scarcity of milk and eggs, the certain cause of the premature decease of a great number of young children . . . and finally, to the exhaustion of the supplies of corn, flour and meat, which, rendering the capitulation of Paris inevitable, marked the precise day for it. . . . Scientific men were asked urgently to find ways for obtaining heat without combustibles; to reconstruct food with mineral materials, without the cooperation of life . . . to reproduce, at least the essential food of man with non-alimentary materials."

"Was it possible," he continued, "to come to the assistance of new-born children by replacing milk, which could no longer be got, by some saccharine emulsion? In this case there was no question of creative chemistry, but only of culinary chemistry. Recipes were not wanting, all reproducing an albuminous liquid with sugar and an emulsion of a fatty body. As a provisional succedanum this artificial milk deserved to be welcomed. But sometimes there was such a conviction in the authors of these preparations that one was forced to dread for the future of the effects of their faith. This was of a nature to make many proselytes, to the great injury of the children at nurse. . . . How could the latter [the milk dealers] have the least scruple when they were taught to manufacture an emulsion which they saw recommended to consumers, as the real equivalent of milk?"

The disastrous effects of feeding infants and young children on such emulsions led Dumas to say: "For these reasons, and many more, for no conscientious chemist can assert that the analysis of milk has made known the products necessary to the life which that aliment contains, we must renounce for the present, the pretensions to make milk, and especially to abstain from identifying any emulsion with this product."

So far as I am aware, the observations of Dumas appear never to have been mentioned by investigators of nutrition. They deserve recognition as the earliest conclusive demonstration that unrecognized nutrients exist, which before had found no place in the philosophy of physiologists and chemists, and were not to be again suspected of existence until, a decade later, Lunin recorded his eventful conclusions.

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