Nutritional Biochemistry and the Amino Acid Composition of Proteins: the Early Years of Protein Chemistry. The Work of Thomas B. Osborne and Lafayette B. Mendel

The Amino-Acid Minimum for Maintenance and Growth, as Exemplified by Further Experiments with Lysine and Tryptophane

The Role of Vitamines in the Diet
(Osborne, T. B., and Mendel, L. B. (1917) J. Biol. Chem. 31, 149–163)

The research described in the two papers in this installment of JBC Classics represents the beginning of nutritional studies as a major focus of biochemistry for many years.

Lafayette Benedict Mendel was Professor of Physiological Chemistry at the Sheffield Scientific School at Yale, his alma mater. From 1921 to 1935, the year he died, he was the Sterling Professor of Physiological Chemistry. Although Mendel’s accomplishments were many and varied, he received major recognition for his work in nutrition. Mendel was one of the first 81 members of the American Society of Biological Chemists (ASBC) and continued to be very active in the Society, serving as both Vice President and President. He was also a member of the first Editorial Board of the Journal of Biological Chemistry (JBC) (1). In addition Mendel was regarded as a gifted teacher. His students referred to him as “The Professor.” On his 60th birthday, Graham Lusk said of him, “He has been the guide, philosopher, and friend to many young men and women; he has guided them to walk by themselves when they were able to stand alone; and he has given them wise council in times of difficulty. Herein he has shown himself as one of the great teachers of his time” (2).

Thomas Burr Osborne was a long time collaborator with Mendel at Yale. Like Mendel, he received his Ph.D. from Yale. He was primarily a chemist, and his interests were in the amino acid composition of proteins, particularly plant proteins. He was Research Chemist at Yale and subsequently Research Chemist at the Connecticut Agricultural Experiment Station at New Haven, Research Associate at the Carnegie Institution, and Research Associate in Biochemistry at Yale. Osborne was quite active in the Society serving as both Vice President and President and was, like Mendel, a member of the first JBC Editorial Board (1).

Osborne’s work focused on determining the exact composition of many plant proteins and showing that the amino acid composition varied enormously among different proteins, even those from the same plant seed. Zein, for example, had 1.5% arginine whereas edestin contained 14.4%. With this kind of compositional data, he was able to suggest that, given such varied composition, different proteins would have different nutritive value.

Osborne’s work fit nicely with Mendel’s interests in determining the relative values of various isolated proteins in both the maintenance of adult animals and growth of young animals. They had determined that zein, the major protein of maize, lacks tryptophane (sic) and lysine. As described in the first of the two JBC Classics reprinted here, they demonstrated that maintenance of adult rats required the addition of tryptophane (sic) to the diet. Rats would not grow, however, unless lysine was also added.

This work led to other nutritional insights including the description of “fat soluble” and “water soluble” vitamins, the subject of the second Classic in this set. The introduction to this paper offers interesting insight into the controversy of the “vitamine (sic) hypothesis.”
and Mendel write that Rohmann, an opponent of the vitamin hypothesis, said, “The assumption that some unknown substances are indispensable for growth is a convenient device for explaining experiments that result in failure — a device that becomes superfluous as soon as the experiment succeeds.” One detects that Mendel, Osborne, and no doubt their contemporary nutritionists took some delight in proving Rohmann wrong.

This work by Mendel and Osborne serves as an introduction to other nutritional biochemistry papers that follow in later installments of JBC Classics, particularly those by E. V. McCollum and E. A. Doisy.

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REFERENCES

1. Chittenden, R. (1945) *The First Twenty-five Years of the American Society of Biological Chemists*, Williams & Wilkins, Baltimore, MD