

*Summary.* Substances injected into the marrow cavity of the tibia of the rabbit and of the sternum of man are almost immediately absorbed into the general circulation. Blood and glucose solutions respectively, by intramedullary injection, corrected rapidly experimental anemia and hypoglycemia induced in rabbits.

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**Formation of the Anti Egg-White-Injury Factor (Biotin) in the Rumen of the Cow.**

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When raw egg white is added to a nutritionally adequate diet, characteristic skin symptoms are produced in various species. The symptoms may be prevented or cured by supplementation with a vitamin-like factor.<sup>1</sup> Evidence has recently been presented<sup>2</sup> that this "anti egg-white-injury" factor is identical with biotin.

It has recently been shown that thiamin, nicotinic acid, riboflavin, pantothenic acid, pyridoxine and vitamin K may be formed in the rumen of the cow.<sup>3</sup> The present experiments indicate that the anti egg-white-injury factor (biotin) is also formed under the same conditions.

In the present experiments, the characteristic symptoms of egg-white-injury were produced in chicks by feeding the following basal diet (Diet ED) : Yellow cornmeal, 55 g; wheat middlings, 20; dried skim milk, 10; commercial casein, 10; ground limestone, 2; steamed bonemeal, 2; alfalfa meal, 1; NaCl, 0.5; MnSO<sub>4</sub>, 0.05; fresh raw egg white, 30 cc. The wet mixture was spread in thin layers and allowed to dry at room temperature, after which 0.3 g of fish oil blend (3000-A, 400-D) was added. Chicks were placed on this diet at hatching. They developed the characteristic symptoms of the syndrome in 3 to 4 weeks. The dermatitis appeared simultaneously at

<sup>1</sup> Boas, M. A., *Biochem. J.*, 1927, **21**, 712; György, P., *J. Biol. Chem.*, 1939, **131**, 733.

<sup>2</sup> György, P., Melville, D. B., Burk, D., and du Vigneaud, V., *Science*, 1940, **91**, 243; du Vigneaud, V., Melville, D. B., György, P., and Rose, C. S., *Science*, 1940, **92**, 62.

<sup>3</sup> McElroy, L. W., and Goss, H., *J. Biol. Chem.*, 1940, **133**, lxv; *J. Nutrition*, in press.

the commissures of the mouth, below the lower mandible, and on the feet. Keratinization and fissuring of the feet were especially striking symptoms. This differentiates the gross symptoms from those of pantothenic acid deficiency, in which the dermatitis first appears at the commissures of the mouth only. Perosis, which in this case was not prevented by choline, also was associated with the egg-white syndrome.

A sample of a diet for ruminants,<sup>4</sup> deficient in the B-complex, was fed as a supplement to diet ED. Simultaneously another group of chicks received as a supplement a sample of the dried rumen contents of a cow<sup>5</sup> fed the ruminant diet. Another group of chicks received a supplement of cane molasses. Other groups received respectively the basal diet ED and a supplement of pantothenic acid. The chicks were observed at frequent intervals for symptoms of "egg-white dermatitis". The results in Table I were obtained.

TABLE I.  
Effect of Various Supplements on Development of the Egg-white Syndrome in Chicks. Ten chicks were used in each group. Diet ED was used as the basal diet.

Supplement in 100 g of diet	No. of birds showing dermatitis at:		Wt in g at:	
	24 days	26 days	20 days	26 days
None	6	7	113	141
10 g ruminant ration	6	7	86	100
10 g dried cow rumen contents	0	0	142	193
70 mg pantothenic acid	8	7	129	138
10 g cane molasses (standard control)	1	1	131	165

The data for dermatitis are given for the 24th and 26th days, since the symptoms developed most rapidly during the fourth week. The cane molasses was kindly assayed by Dr. E. E. Snell for biotin by a microbiological method. It was found to contain 2.6  $\mu$ g of biotin per gram. Assuming that the anti egg-white-injury factor is identical with biotin, it appears that the dried cow-rumen contents was a slightly better source of biotin than the cane molasses. The biotin content of the ruminant diet was apparently as low as, or lower than the chick basal diet ED. Evidently the anti egg-white-injury factor (biotin) was formed in the rumen, presumably by microbial synthesis. Pantothenic acid was ineffective at a level corresponding to 50 times the requirement of the chick.

*Summary.* The anti egg-white-injury factor (biotin) was found to be formed in the rumen of a cow receiving a ration which was low in this factor.

<sup>4</sup> McElroy, L. W., and Goss, H., *J. Biol. Chem.*, 1939, **130**, 437.