CLXVI. THE QUESTION OF THE IDENTITY OF A BACTERIAL GROWTH-PROMOTING FACTOR WITH VITAMIN B₁.

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THE identity of bacterial growth factors with vitamin B has been the subject of many papers. Williams [1919] first suggested that vitamin B was identical with the substance stimulating the growth of yeasts in a synthetic medium, while Kligler [1919] also showed that the properties of the two substances were very similar. Uyei [1927] found that vitamin B, isolated from yeasts and certain fruits, had a marked stimulating effect on the growth of *Mycobacterium tuberculosis*. Lumière [1920] showed however that vitamin B and the factor for micro-organisms differed in their resistance to heat, while Emmet and Stockholm [1920] found that "bios" and the antineuritic vitamin were distinct substances. Later Funk and Dubin [1921] separated a "bacterial vitamin" from vitamin B by adsorption on fuller's earth. Willaman and Olsen [1923] considered "bios" to be similar in nature to vitamins but showed that "bios" differed from vitamin B in certain properties. Wyon [1923] concluded that vitamin B did not stimulate the growth of bacteria. It is now generally agreed that although substances rich in vitamin B stimulate the growth of yeasts, streptococci and certain pathogenic organisms, the factor concerned is not vitamin B but some closely associated substance.

This paper describes an investigation of the vitamin B₁ content and bacterial growth-promoting properties of three commercial peptones. The test organism used was a lacto-bacillus requiring for good growth, not only the intermediate products of protein degradation but some factor present in all tissues containing vitamin B₁ [Davis and Mattick, 1929, 1930]. In media containing "peptone" nitrogen, dextrose and this factor, the organism grows luxuriantly and produces a rich red-brown pigment, apparently carotenoid in nature. If such a medium be deprived of the factor, poor growth without pigment is obtained. The relative growths in agar media containing 2 % dextrose, 1 % peptone, and salts are given in Table I.

Table I.

	Growth	Pigment
Allen and Hanbury's peptone dextrose agar	+	-
Hopkins and Williams's "	++	+
Parke Davis's "	+++	++
Allen and Hanbury's " + trace yeast extract	+++	+++

Since the concentrations of available foodstuffs in the media are approximately the same, it may be assumed that the large differences in growth observed are due to some factor, present in yeast extract in large amounts and in the peptones in smaller and variable quantities.

Fig. 1. A = Marmite autoclaved at 120° at pH 9 for 3 hours.
↓ = Whole marmite substituted for autoclaved.

The vitamin B₁ contents of the peptones were compared by feeding the peptones to young rats on a diet deficient in vitamin B₁. Nine rats from two litters were divided into three groups of three each and fed on the following basal diet.

Casein (B.D.H. light white)	...	20	} <i>ad lib.</i>
Wheat starch		76	
McCollum salt mixture		4	
Distilled water	<i>ad lib.</i>		
Cod-liver oil		3 drops per rat per day	
50 % marmite		1 cc. per rat per day	

When a steady growth rate was obtained, 50 % marmite which had been autoclaved at 120° for 3 hours with an excess of baryta was substituted for the whole marmite. When the growth curve had become flattened, each rat was given 0.5 g. peptone daily in solution so that each group of three rats received a different peptone. After 7 days, this amount of peptone having had no effect on the growth curve of the animals, the peptones were fed *ad lib*. The rats consumed between 1 and 2 g. daily but still fell in weight. When typical symptoms of vitamin B₁ deficiency (paralysis of hind-legs) appeared, whole marmite was fed and produced a rapid recovery. The growth rates are given in Table II.

Table II.

Diet	No. rat-days	Daily increase in g.
Full basal	72	3.0
„ less vitamin B ₁ 1st period	72	3.0
„ „ 2nd „	72	0.7
„ „ 3rd „	45	-0.53
„ „ + peptone I 4th period	57	-0.83
„ „ + peptone II „	57	+0.14
„ „ + peptone III „	57	-0.30

These data indicate that the peptones contain only negligible amounts of vitamin B₁.

Table III summarises the vitamin B₁ and bacterial factor content for the organism under test.

Table III.

Peptone	Vitamin B ₁ content	Bacterial factor
Allen and Hanbury's	Nil	+
Hopkins and Williams's	Trace	++
Parke Davis's	Trace?	+++

Vitamin B₁ concentrates prepared in different laboratories and by different methods were then tested for their bacterial growth-promoting properties. Although of the same order of potency for rat protection on a diet deficient in vitamin B₁, the concentrates varied widely in their ability to stimulate the growth of the test organism, some being quite inactive.

Table IV.

Date	Vitamin B ₁ concentrate	Growth	Pigment
	Basal medium	+	-
15. xi. 29	„ + Univ. Coll. concentrate	++	- to +
15. xi. 29	„ + Lister Inst. „	++	+++
20. i. 30	„ + N.I.R.D. „	++	++ to +++
28. i. 30	„ + Univ. Coll. „	{ ++ ++	- to +
13. ii. 30	„ + Lister Inst. „	{ ++ ++	+++
	„ + yeast extract	+++	+++

Hence not only are vitamin B₁-deficient materials able greatly to stimulate the growth of the micro-organisms under investigation, but vitamin B₁ concentrates of proved potency for rats have, in some cases, no effect on the growth of the organism.

SUMMARY.

1. Commercial peptones contain only negligible amounts of vitamin B₁.
2. There is no relation between the vitamin B₁ content of peptones and their ability to stimulate the growth of an organism requiring a vitamin B-like factor.
3. Vitamin B₁ concentrates of the same order of potency for rat protection had widely different effects on the growth of the test organism. Since some had no effect at all, it may be concluded that vitamin B₁ itself has no influence on the metabolism of the organism. The bacterial growth-stimulating substance and vitamin B₁ are not identical.

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