VITAMIN B_6 AS A YEAST NUTRILITE

Sir:

In corroboration of the findings of Schultz, Atkin and Frey [THIS JOURNAL **61,** 1931 (1939)], we wish to indicate that we have independently found that vitamin B_6 is effective in yeast growth stimulation. A typical experiment is outlined below.

The basal medium was similar to that used in previous work [Williams and Saunders, *Biochem. J.*, **28,** 1887 (1934)], but contained 0.1 g. of aspartic acid per liter instead of asparagin. It also contained 0.03 mg. of thiamine, 0.3 mg. of β-alanine, and 30 mg. of autolyzed liver extract per liter. The liver extract had been treated with charcoal and with fuller's earth. The yeast seeding was 0.03 mg. of a pure culture isolated from a Fleischmann cake per 12 ml. culture and the growth period was fourteen hours at 30°. The vitamin B_6 used had been generously furnished by Dr. Samuel Lepkovsky.

TABLE I

EFFECT OF VITAMIN B_6 ON YEAST GROWTH

Vitamin B_6 added (γ per culture)	Yeast crop (mg. per 12 ml. culture)
0	4.47
0	4.53
0.0005	4.44
.001	4.95
.005	6.29
.01	6.82
.05	8.01
.1	8.58
.5	7.94
1	8.27

This finding makes more emphatic the close relationship between "B" vitamins and substances effective for the stimulation of the growth of yeasts (as well as other microörganisms).

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VITAMIN K ACTIVITY OF SOME QUINONES

Sir:

In view of the recent note of Almquist and Klose [THIS JOURNAL, **61,** 1611 (1939)] and their conclusion "that phthiocol is the simplest member of an homologous series of anti-hemorrhagic substances," we are submitting a report on the potencies of a rather extensive series of quinones. As soon as our investigations on vitamin K indicated a quinone structure [THIS JOURNAL, **61,** 1295 (1939)], we began a survey of the potencies of quinones.

Using the assay procedure previously described [*J. Soc. Exp. Biol. Med.*, **40,** 478 (1939); **41,** 199 (1939)] the following quinones were found to be inactive at a level of 5 mg.: anthraquinone β-sulfonic acid, thymoquinone, tolu-*p*-quinone, dihydro-anthraquinone diacetate, 1,2-naphthoquinone, phenanthraquinone, diamylhydroquinone, *p*-xyloquinone, 2-allyl-1,4-naphthoquinone (tested only at 2.0 mg.) and 1,4-benzoquinone.

With the exception of 2-allyl-1,4-naphthoquinone all of the derivatives of 1,4-naphthoquinone show vitamin K activity. Moreover, the diacetates of two of the dihydro-1,4-naphthoquinones show activity, perhaps due to hydrolysis in the gastro-intestinal tract. 2-Allyl-4-amino-1-naphthol hydrochloride in aqueous solution gives a positive reaction.

Our data are summarized in Table I. They show that the 2-methyl-1,4-naphthoquinone is the most active compound in this group; however, when compared with the natural vitamin K_1 (1000 units per mg.) or K_2 (660 units per mg.), the activity is relatively insignificant. Other more complex derivatives of 1,4-naphthoquinone are being prepared for a study of their physiological activity.

TABLE I

Active compounds	Our standard units per milligram
1,4-Naphthoquinone	1.0
2-Methyl-1,4-naphthoquinone	10.0
2-Ethyl-1,4-naphthoquinone	8.0
Phthiocol, 2-methyl-3-hydroxynaphthoquinone	2.0
2-Bromo-3-methyl-1,4-naphthoquinone	> 0.10
2,3 - Dibromo - 2 - methyl - 1,4 - dioxotetrahydronaphthalene	> 0.10
1,4-Naphthalenediol diacetate	0.50
2-Methyl-1,4-naphthalenediol diacetate	5.00

Our discovery of the activity of 1,4-naphthoquinones and the inactivity of other quinones has been of considerable assistance in developing the structure of vitamin K_1 [THIS JOURNAL, **61,** 1928 (1939)].

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