

LETTERS TO THE EDITORS

CHOLINE, PANTOTHENIC ACID, AND NICOTINIC ACID AS ESSENTIAL GROWTH FACTORS FOR PNEUMOCOCCUS

Sirs:

A strain of highly virulent Type I pneumococcus has been grown in a medium of pH 7.8 containing, per 10 cc., acid-hydrolyzed gelatin 60 mg., glutamic acid 1 mg., cystine 0.25 mg., KH_2PO_4 50 mg., MgSO_4 10 mg., glucose 50 mg., thioglycolic acid 0.5 mg.,

*Influence of Varying Concentrations of Choline, Pantothenic Acid,
and Nicotinic Acid**

Meat infusion broth controls, Type I, 2.4; Type II, 2.3; Type V, 2.5; Type VIII, 2.4.

Nicotinic acid	Choline	Nephelometer readings					
		Type I		Type II		Type V	Type VIII
		Pantothenic acid, γ per cc.					
		1	0.25	1	0.25	1*	1*
γ per cc.	γ per cc.						
50	10	2.9	>4.7	2.4	>4.7	3.8	3.8
50	5	2.5	2.8	2.4	>4.7	3.5	3.2
50	2.5	2.4	2.5	2.4	2.5	3.4	2.8
50	1	3.4	3.4	3.3	3.6	4.7	3.0
50	0.5	4.2	4.5	4.0	4.6	>4.7	>4.7
10	10	3.3	>4.7	2.5	>4.7	>4.7	4.4
10	5	2.7	3.0	2.3	>4.7	3.5	4.3
10	2.5	2.7	3.7	2.4	2.5	3.4	3.4
10	1	3.7	3.9	3.5	3.6	>4.7	>4.7
10	0.5	4.4	>4.7	4.1	4.7	>4.7	>4.7
2	10	3.7	>4.7	2.5	>4.7	>4.7	>4.7
2	5	2.7	3.3	2.4	>4.7	3.5	>4.7
2	2.5	3.0	3.9	2.4	2.6	3.6	3.5
2	1	3.8	4.2	3.6	3.9	>4.7	>4.7
2	0.5	4.7	>4.7	4.5	4.7	>4.7	>4.7

*0.25 microgram per cc. of pantothenic acid gave readings of >4.7 with Types V and VIII throughout.

and flavin 0.001 mg. To this were added choline, pantothenic acid, and nicotinic acid in suitable proportions.

One strain each of highly virulent Types II, V, and VIII pneumococci was grown in a similar medium in which the gelatin hydrolysate was replaced by a mixture of glutamic acid 10 mg., glycine 2.5 mg., asparagine 2.0 mg., leucine 1.5 mg., arginine 0.75 mg., alanine, lysine, cystine, and methionine each 0.5 mg., histidine, β -alanine, and tryptophane each 0.25 mg., norleucine 0.15 mg., oxyproline 0.1 mg., and phenylalanine 0.1 mg.

After test cultures in the various media had been incubated at 37° for 15 to 18 hours, their turbidity was measured with a Gates nephelometer.¹ A reading of 4.7 or more indicated essentially no growth; a reading of 3.0 or less, good growth.

The optimum concentration of choline required by each type was found to be about the same. Nicotinic acid showed a wider range but was, in part, dependent upon the concentrations of both choline and pantothenic acid. The amount of pantothenic acid necessary for growth was influenced by the concentrations of choline and nicotinic acid as well as by the type tested.

The omission of choline or nicotinic acid prevents growth, as does the omission or hydrolysis of pantothenic acid. The presence of thioglycolic acid (or presumably a similar reducing agent) is also essential for growth.

Antitoxin and Vaccine Laboratory
Massachusetts Department of Public Health
Jamaica Plain

LEO RANE

Department of Biological Chemistry
Harvard Medical School
Boston

YELLAPRAGADA SUBBAROW

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