INVOLVEMENT OF ASPARTIC ACID IN PURINE BIOSYNTHESIS

by

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The incorporation of isotopic nitrogen from ^{15}N-aspartic acid, ^{15}N-glutamic acid or glutamine (amide ^{15}N) into the 1,3-positions of hypoxanthine has been reported to be approximately equivalent to one atom of nitrogen for each of these compound for each molecule of glycine converted to the purine[1].

In the present investigation, the biosynthesis of purines in *Lactobacillus arabinosus* 17–5 has been found to be dependent upon exogenous aspartic acid or conditions which allow biosynthesis of aspartic acid. As indicated in Table I, *L. arabinosus* requires either purines or aspartic acid for growth; however, 5-amino-4-imidazolecarboxamide replaces purines in promoting growth under these conditions, and sodium bicarbonate in moderate amounts allows adequate biosynthesis of aspartic acid and purines. If the biotin in the medium is replaced by a source of oleic acid (tween 80, 5 mg per 5 ml), aspartic acid but not sodium bicarbonate promotes growth of the organism.

TABLE I

REPLACEMENT OF PURINES BY ASPARTIC ACID OR BICARBONATE

Test organism, *L. arabinosus*, incubated 28 hours at 30°*.

Amount γ per 5 ml	*Supplements*					
	Adenine	*Guanine*	*Hypoxanthine*	*5-Amino-4-imidazole-carboxamide*	*DL-Aspartic acid*	*Sodium bicarbonate*
	*Galvanometer readings***					
0	10	10	10	10	10	10
1	22	20	29	32	—	—
2	34	24	33	39	15	—
5	56	36	46	62	22	—
10	63	42	56	64	32	—
20	68	57	61	69	51	—
50	74	62	61	75	71	14
100	—	—	—	—	78	24
200	—	—	—	—	—	48
500	—	—	—	—	—	70

* Testing procedure and medium as previously described[2] except adenine, guanine and aspartic acid omitted from basal medium and glutamic acid was increased to 250 γ per 5 ml.

** A measure of culture turbidity; distilled water reads 0, an opaque object 100.

Although *L. arabinosus* may utilize either aspartic acid or purines for growth under the above conditions, purines exert only a sparing action on the aspartic acid requirement for growth during shorter incubation periods. The effects of purines in sparing the aspartic acid requirement either in biotin deficient or biotin supplemented media and in increasing the inhibition index obtained by cysteic acid inhibition of the utilization of aspartic acid indicate a role of aspartic acid in the biosynthesis of purines in *L. arabinosus* under these testing conditions.

If the role of aspartic acid in the biosynthesis of purines involves the transfer of nitrogen, the four carbon unit is the limiting factor and not amino nitrogen, since bicarbonate can replace aspartic acid. Since bicarbonate has been found to be incorporated into the 6-carbon of purines[3], this incorporation may involve an intermediate four carbon unit which is derived either from aspartic acid or from a carboxylation reaction requiring biotin, and which may function indirectly or directly by condensation with a two carbon unit derived from glycine.

REFERENCES

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