Table 1

Additions per 100 c.c. basal medium	Without aureomycin			With aureomycin (300 μ gm. per 100 c.c.)		
	Cell mass (gm. per lit.)	Pentose nucleic acid (per cent)	Deoxypentose nucleic acid (per cent)	Cell mass (gm. per lit.)	Pentose nucleic acid (per cent)	Deoxypentose nucleic acid (per cent)
Folic acid, 200 μ gm.	0.54	11.32	1.92	0.48	9.56	1.67
Vitamin B ₁₂ , 200 μ gm.	0.18	8.80	1.85	0.16	7.28	0.83
Folic acid + vitamin B ₁₂ , 200 μ gm. each	0.60	10.00	2.80	0.46	9.05	2.54
Vitamin B ₁₂ , 400 μ gm.	0.33	12.42	2.14	0.27	12.17	2.08
Folic acid, 200 μ gm. + vitamin B ₁₂ , 400 μ gm.	0.65	11.67	3.85	0.60	12.14	2.78

Interference in normal nucleic acid metabolism of micro-organisms has been observed for penicillin^{3,4}. More recently, it has also been reported that cultural conditions favouring increased pentose nucleic acid content of bacterial cells enhance resistance of *Haemophilus pertussis* cells to aureomycin among other antibiotics⁵.

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Tetrahydropteroyl Glutamic Acid in Serine Synthesis and Degradation

PTEROYLGLUTAMIC acid (PGA) has been implicated in the synthesis of serine from glycine¹⁻³ and in the breakdown of serine to glycine⁴, and a soluble enzyme system from pigeon liver catalysing the interconversion of serine and glycine showed a marked activation by the acid⁵.

In recent studies the enzyme preparation supplemented with PGA was found to synthesize [2 - ¹⁴C]-serine from [2 - ¹⁴C]glycine and formaldehyde, and [3 - ¹⁴C]serine from unlabelled glycine and H¹⁴CHO. Formaldehyde could not be replaced by formate for the synthesis of serine in this system, even in the presence of reducing agents such as homocysteine or ascorbic acid. Since the preparation also catalysed the breakdown of [2 - ¹⁴C]serine to [¹⁴C]glycine and formaldehyde, it was able to catalyse the formation of [2 - ¹⁴C]serine from unlabelled L-serine and [2 - ¹⁴C]glycine⁶.

For this reaction maximum activity was obtained with dialysed enzyme preparations when supplemented with yeast extract or a combination of adenosine triphosphate (ATP) and diphosphopyridine nucleotide (DPN), in addition to PGA. The reaction was also favoured by the addition of ascorbic acid and by anaerobic conditions. On the other hand, for net serine synthesis from glycine and formaldehyde or for net serine breakdown to glycine and formaldehyde, addition of PGA alone fully activated the enzyme preparation. These results may be explained by assuming that before activating serine-glycine interconversion, PGA undergoes enzymic reduction. ATP, DPN and yeast extract preparations are presumed to be involved in the reduction of PGA, in which ascorbic acid is known to participate⁶. In

net serine synthesis or net serine breakdown the formaldehyde added or accumulated respectively is assumed to reduce pteroylglutamic acid.

The following facts are consistent with this view: (1) 5:6:7:8-tetrahydroPGA was more effective than PGA and other PGA derivatives in activating the enzyme system; (2) when the enzyme system was activated by tetrahydroPGA, [2 - ¹⁴C]serine synthesis from [2 - ¹⁴C]glycine and unlabelled L-serine proceeds without addition of other co-factors, and without the considerable lag period evident when PGA and yeast extract were added; (3) 4-aminoPGA (aminopterin), which is known to inhibit reduction of PGA to tetrahydroPGA⁷, strongly inhibited serine-glycine interconversion when PGA and yeast extract were added, but not when tetrahydroPGA was added.

Leucovorin (5-formyl-5:6:7:8-tetrahydro-PGA) was similar to PGA in its activation of serine-glycine interconversion, and it also required the simultaneous addition of yeast extract. Heating the enzyme to 53° did not impair its activity for serine-glycine interconversion when tetrahydroPGA or PGA and yeast extract were added, but this treatment considerably diminished its activity when leucovorin was the co-factor.

These results indicate that tetrahydroPGA rather than leucovorin or N¹⁰-formylPGA plays the central part in one-carbon transfers, and suggest that tetrahydroPGA combines reversibly with formaldehyde in the presence of the enzyme, possibly forming the imidazolidine derivative in which a methylene group links the N⁵ and N¹⁰-positions of tetrahydroPGA. It is suggested that this intermediate might then react reversibly with glycine and water to form serine, and perhaps might transfer the methylene group derived from formaldehyde to homocysteine, forming methionine by a process in which vitamin B₁₂ may be involved. In the incorporation of formate into serine, formate presumably reacts with tetrahydroPGA to form leucovorin, which is then reduced by a heat-sensitive enzyme to the imidazolidin type of pteridine intermediate. A complete report of this work will be published elsewhere.

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