specifically in *p*-aminobenzoic acid synthesis. Higher concentrations of the acid, up to 1 μgm./ml., provide more rapid, yet less than normal, growth of mutant 83-1. Normal growth-rate, however, appears with the addition of shikimic acid (a 2,3,4,5-tetrahydrogallic acid).

Shikimic acid has been reported to be a precursor of the above four aromatic metabolites[2,3]. The facts presented here lead one to postulate a fifth metabolite, compound *Y*, that can be formed readily from shikimic acid and less readily from *p*-aminobenzoic acid. A substance with *Y* activity was, indeed, found in culture filtrates of the parent wild type, and was distinguished by paper chromatography (using response of 83-1 for recognition) from *p*-aminobenzoic acid and shikimic acid. Chromatography was complicated by the presence of *Y* activity in the paper (Whatman No. 1).

The derivation of *Y* from shikimic acid or *p*-aminobenzoic acid in the cell suggested the possibility of a simple aromatic structure. The activity in filter paper further suggested that the substance involved might already be known from studies on wood chemistry. Fifty available aromatic compounds were therefore tested. Among these, only *p*-hydroxybenzoic acid was active; as little as 0·01 μgm./ml. supported rapid growth of 83-1 in the presence of its quadruple supplement. The active materials in culture filtrate and filter paper were indistinguishable from *p*-hydroxybenzoic acid by paper chromatography with three solvents. The high order of activity shown by *p*-hydroxybenzoic acid leads us to propose that it be considered a bacterial vitamin. It may be further noted that wild type *E. coli* also excretes several other vitamins, including *p*-aminobenzoic acid[2].

The method of mutants has been widely used for the discovery of metabolic precursors; the present observations represent an extension to the recognition of a new metabolite. We have found *p*-hydroxybenzoic acid, like *p*-aminobenzoic acid, in significant concentrations (relative to microbiological requirements) in yeast autolysate but not in liver extract. *p*-Hydroxybenzoic acid, therefore, has promise as a model for synthesis of chemotherapeutic analogues selectively toxic to micro-organisms. This hope is encouraged by the observation that the growth-slowing effect exerted on *E. coli* by 100 μgm./ml. of 4,4′-dihydroxydiphenyl sulphone (kindly furnished by Dr. M. E. Hultquist of the American Cyanamid Company) is partly overcome by 0·1 μgm./ml. of *p*-hydroxybenzoic acid.

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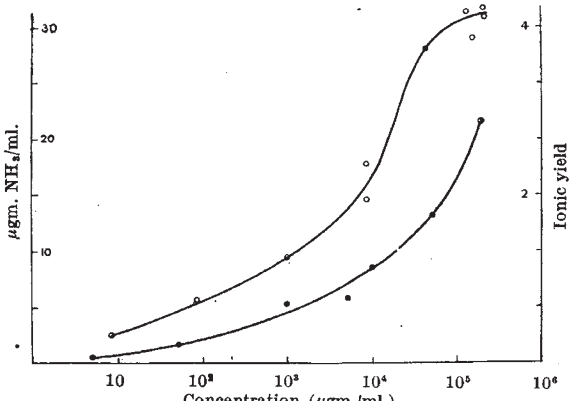
Deamination of Aqueous Solutions of L-Serine by X-Radiation

THE deamination of glycine by X-radiation[1] is dependent on the concentration of the glycine solution in a way that is different from the more common relationship of yield/concentration found for solutions of many inorganic solutes[2] and viruses[3], and, for example, carboxypeptidase[4]. The inactivation of this enzyme by X-radiation is independent of the concentration over a wide range, except in extremely dilute solutions (less than 3×10^{-6} *M*). The yield of ammonia, however, from glycine and other amino-acids shows a continuous rise up to nearly saturated solutions, that is, an approximately 20 per cent solution in the case of glycine. The liberation of sulphur from thiourea[5] follows a similar course. The yield/concentration relationship is not confined to substances of low molecular weight, for McDonald has recently found[6] that trypsin, which has apparently the same molecular weight as carboxypeptidase, also shows a similar rise up to a 1 per cent solution (the highest concentration which could be used for technical reasons).

It was of interest to find conditions under which it would be possible to show that the rise of yield with concentration of the amino-acid, which cannot be expected to continue indefinitely, would show signs of a 'levelling off'. Glycine, while possessing a reasonably high solubility, has too low an ionic yield for this purpose. On the other hand, DL-serine, which has the advantage of an ionic yield almost double that of glycine at equimolar concentrations (ionic yield for DL-serine is 4·2 for a 5 per cent or nearly saturated solution), is far too insoluble.



Yield/concentration curve: O—O—, L-serine; ●—●—, glycine. X-ray dose, 166,000 r.

L-Serine, however, combines the two features—high solubility and high enough ionic yield—desirable for a study of this kind. The accompanying graph compares the deamination of glycine and L-serine over the complete range of concentrations and shows that, in general, the curves for both acids follow similar trends. In the L-serine curve, however, at nearly saturated solution there is a distinct 'levelling off' tendency in the yield of ammonia. All solutions in this investigation were air-saturated, and the concentrations stated are weight of amino-acid/ml. of solution.

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