heterotrophically on succinate, but which were derived from a 0.1 per cent autotrophically grown inoculum, contain a carbon dioxide fixation system identical with or similar to the reductive pentose phosphate cycle.

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Effects of Incorporation of Iododeoxyuridine on *Escherichia coli*

A VARIETY of base analogues which are incorporated into deoxyribonucleic acid (DNA) affect the growth of mammalian cells, bacteria, plant and animal viruses. It has been shown^{1,2} that thymine substitution by halogenated analogues is higher in thymine-less than in wild bacterial strains. To increase the incorporation in wild strains, inhibitors of thymidylate synthesis were used (aminopterin or sulphanilamide). The substitution of the natural base by the brominated analogue produces some physiological and genetical effects. It was demonstrated³ that bacteria labelled with bromouracil are highly sensitive to ultra-violet irradiation. In some cases the replacement of thymine in DNA produced a significant increase of the frequency of mutations at specific locations of phages *T₄* or *T₂* (refs. 4 and 5) or in *Salmonella typhimurium* at the tryptophan *D* locus⁶. In contrast to the brominated analogues, the iodinated analogues of thymine were not thoroughly examined until now.

To enhance the incorporation of iododeoxyuridine (IUdR) into a wild-strain of *Escherichia coli* I used fluorodeoxyuridine (FUdR), a specific inhibitor of thymidylate synthetase. Bacteria propagated in nutrient broth in log-phase were transferred into a minimal medium supplemented with 200 µg/ml. IUdR and 1 µg/ml. FUdR and grown for 3 h. In the presence of the fluorinated analogue, 43 per cent of thymine was substituted by IUdR, while without FUdR only 18 per cent. Bacteria containing IUdR showed an increased sensitivity to ultra-violet light. This sensitization of micro-organisms labelled with IUdR to ultra-violet light was significantly lower than that of bacteria containing bromodeoxyuridine.

The resulting radiosensitization, expressed as ultra-violet dose ratio for identical survivals of normal and analogue-labelled cells (dose reduction ratio), amounted to as much as 2.2 (43 mol per cent IUdR substitution) or 3.4 (46 mol per cent BUdR substitution). At the same time the rates of mutation were estimated in the system from streptomycin dependent to streptomycin independent. In bacteria containing a large amount of IUdR (about 50 per cent) the frequency of mutations increased 20 times, whereas in micro-organisms containing 15–20 per cent of the analogue the number of mutants was increased only three times. After ultra-violet irradiation, the frequency of mutation increased significantly, but the rate of the increase was higher in the control culture than in that containing IUdR. After irradiation with a dose of 2,000 ergs/mm² the number of mutants per survivals in the normal culture was even higher than in IUdR-labelled bacteria. This was presumably connected with the selection by ultra-violet light of IUdR labelled bacterial mutants. DNA isolated from bacteria containing

IUdR showed a broadening of the profile of hyperchromasis after heating in comparison with the normal DNA.

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Utilization of Amino-Acids during Metabolism in *Escherichia coli*

WHILE engaged in the examination of metabolism and hydrolysis by soil bacteria of benzoic acid derivatives, amino-acids, and acylated amino-acids^{1–3}, we have shown that there was a significant difference in strains of soil bacteria in their capability of metabolizing organic substances of different structures. We have now examined the metabolic activities of twenty-five strains of *Escherichia coli* standard *O* group on the following nineteen amino-acids to be used as a sole source of carbon: L-glutamic and DL-aspartic acids, DL-alanine, DL-serine, glycine, DL-valine, DL-leucine, L-isoleucine, DL-phenylalanine, L-tryptophan, DL-threonine, L-lysine, DL-methionine, L-cystine, L-arginine, L-histidine, L-tyrosine, L-proline, L-hydroxyproline.

The constituents of the culture medium used were: ammonium chloride, 0.1 gm; dipotassium hydrogen phosphate, 0.1 gm; crystalline magnesium sulphate, 0.05 gm; 1 per cent crystalline calcium chloride, 2 drops; 1 per cent crystalline ferric chloride, 1 drop; DL-amino-acid to be tested, 0.2 gm (L-amino-acid, 0.1 gm; L-cystine and L-tyrosine, 0.02 gm); distilled water, 100 c.c.; pH 7.4–7.6 (adjusted with 10 per cent sodium hydroxide).

Special attention may here be directed to the following points: (1) All 25 strains grew luxuriantly in the synthetic medium containing alanine, aspartic and glutamic acids or proline as the sole source of carbon at 37° within four days. This cultivation experiment was repeated three times in succession. (2) Of 25 strains, 19 were able to utilize serine as well as alanine. (3) The following 14 amino-acids could not or only just be utilized by any of 25 strains at 37° in four days: glycine, valine, leucine, isoleucine, phenylalanine, tryptophan, threonine, lysine, methionine, cystine, arginine, histidine, tyrosine, hydroxyproline. (4) The response of *E. coli* to histidine is worth noting from the point of view of phylogeny for Enterobacteriaceae when considered together with the fact that some strains of *Klebsiella*, *Cloaca*, *Citrobacter*, *Hafnia* and *Proteus* could utilize histidine as a source of carbon in our preliminary experiments. (5) 8 essential amino-acids such as tryptophan, lysine and methionine could not be utilized by *E. coli*.

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