glyoxylate considerably decreased $^{14}\text{CO}_2$ release from $[1-^{14}\text{C}]\text{glycollate}$ and $[2-^{14}\text{C}]\text{glycollate}$.

These results indicate that glycollate is oxidized to glyoxylate before decarboxylation. Glyoxylate is further oxidized by H_2O_2 , generated endogenously, to formate and CO_2 by a non-enzymic reaction. The formate, derived from C-2 of glyoxylate, can then be further oxidized (Leek & Butt, 1972). The release of CO_2 from both carbon atoms of glyoxylate and the low activities of the oxidizing system both argue against a significant participation of these oxidations in photorespiration.

B. H. and A. E. L. thank the Science Research Council for Research Studentships.

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The Occurrence of an Induced Glyoxylate Cycle in Wheat Aleurone Tissue

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The glyoxylate cycle occurs in several oleaginous seeds during germination, whereas in carbohydrate-storing seeds the cycle has been reported only in the scutellum of maize (Oaks & Beevers, 1964). Little has been reported on the induction of glyoxylate-cycle activity during germination. Our previous studies in germinating wheat (*Triticum vulgare*) have indicated that in the bran (aleurone tissue) triglycerides probably constitute a major nutrient reserve whose metabolism is induced early during germination (Laidman & Tavener, 1971). We have therefore looked for a glyoxylate cycle during germination in this species and we have investigated the principle factors concerned with its induction.

During germination, isocitrate lyase and malate synthetase activities in the aleurone tissue rose from zero in the quiescent grain to a maximum at 6 days, after which both enzyme activities declined. No activity was found in other tissues. When de-embryoed grain (endosperm halves) were incubated alone for up to 8 days, isocitrate lyase failed to appear, and malate synthetase appeared at only low activities in the aleurone tissue. The addition of 100nm-gibberellic acid to the incubating endosperm halves caused the development of enzyme activities up to the values found in the intact germinating grain. The hormone was effective at concentrations ranging from 0.01 nm to 1 mM with an optimum concentration at 100nm. Of several other plant growth regulators

tried, only 1 mM-glutamine and 1 mM-hydroxylamine induced any activity (to about 40% of that produced by gibberellic acid).

The present results show that the induction of glyoxylate-cycle activity in aleurone cells is dependent on the presence of the embryo, and that gibberellic acid is probably the principle inducing factor for the activity. This role of gibberellic acid is interesting in that it is the first recorded example of the complete hormonal induction of the glyoxylate cycle in plants, and is a rare example of a non-hydrolase non-secretory enzyme system induced by gibberellic acid in germinating cereals.

We thank the Ministry of Agriculture for the award of a Research Studentship to R. I. D.

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A Comparison of some Properties of the 1,2-Dihydroxynaphthalene Oxygenase and Catechol 2,3-Oxygenase Activities in Naphthalene-Grown *Pseudomonas* sp. N.C.I.B. 9816

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Evans *et al.* (1965) suggested that the ability of a single organism to open rings of 1,2-dihydroxyanthracene, 3,4-dihydroxyphenanthrene, 1,2-dihydroxynaphthalene and catechol by *meta* cleavage might be due to a single oxygenase of low specificity present under the various growth conditions. To test this hypothesis, the properties of the catechol 2,3-oxygenase and the 1,2-dihydroxynaphthalene oxygenase activities were compared in cell-free extracts of naphthalene-grown *Pseudomonas* sp. N.C.I.B. 9186.

Catechol 2,3-oxygenase activity was assayed at pH 7.5 by the usual spectrophotometric method (Nozaki *et al.*, 1963). 1,2-Dihydroxynaphthalene oxygenase activity was assayed in a Clark oxygen electrode by measuring the rate of O_2 uptake when 1,2-dihydroxynaphthalene (1 μmol) in anhydrous tetrahydrofuran was added to cell-free extract in 50mM-phosphate buffer, pH 7.0; as long as the pH was not much above 7.0 and the amount of activity present was above a critical value, the auto-oxidation of substrate was negligible and the rate was directly proportional to the amount of extract added.

Both activities were unstable in air, each declining by 40% after 24 h at 4°C, and both were stabilized to

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