microscopy. Nuclear, chloroplast and mitochondrial fractions were almost completely resolved, as indicated by DNA, chlorophyll and ubiquinone distribution.

α -Tocopherol and α -tocopherolquinone were largely present in the chloroplasts (92% and 88% respectively). γ -Tocopherol occurred in significant quantities in all fractions, but was concentrated in chloroplasts (55%) and the microsomal fraction (24%). δ -Tocopherol was fairly evenly distributed among fractions: nuclear, 16%; chloroplast, 28%; mitochondrial, 17%, microsomal, 13%; supernatant, 26%.

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A Study of Mitochondrial Complementation in Wheat

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It has been reported that mixtures of mitochondria from various inbred lines of wheat occasionally exhibit oxidative and phosphorylative activities that are higher than those of mitochondria from either pure line, as also are the activities of mitochondria from hybrids of these lines (Sarkissian & Srivastava, 1969a). This phenomenon has been called 'mitochondrial complementation' (McDaniel & Sarkissian, 1966).

Attempts were made to confirm the published results of Sarkissian & Srivastava (1969b,c) by using their method for the very rapid isolation of mitochondria from varieties of wheat that, when crossed, showed heterosis. No success was achieved until a number of modifications were made to the procedure and very strict attention was paid to details of the method. A standard oxygen-electrode system was used to measure the oxygen consumption during the phosphorylation of known amounts of ADP by mitochondria isolated from each of the pure lines under consideration, and also from 1:1 mixtures of mitochondria from these lines selected in pairs and from the relevant hybrids, if available.

Measurements of mitochondrial activity in two varieties of wheat provided by the Plant Breeding Institute showed evidence of complementation, and the hybrid demonstrated positive heterosis with respect to yield of grain. One of these varieties also gave mitochondria that when mixed with particles

from a third variety demonstrated negative complementation, and the hybrid showed negative heterosis. These results are judged to be sufficiently encouraging to warrant further investigations into the phenomenon of mitochondrial complementation and its relation with hybrid vigour.

This work forms part of a joint project between the Glasshouse Crops Research Institute and the Plant Breeding Institute, Cambridge. Specialized laboratory facilities at the University of Sussex were generously provided by Professor J. F. Sutcliffe.

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Allosteric Properties of Wheat-Germ Aspartate Transcarbamoylase

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Aspartate transcarbamoylase (EC 2.1.3.2), purified approx. 20-fold from commercial wheat germ, is inhibited by UMP; the enzyme is thus potentially a site for feedback regulation of the pyrimidine-biosynthetic pathway in the germinating wheat embryo. This and other features of the enzyme have been reported in a previous communication (Yon, 1971).

The same partially purified preparation has now been further characterized. Catalytic activity and sensitivity to inhibition by UMP are both pH-dependent. The most prominent feature of the pH-activity profile is a single sharp peak between pH 9.5 and 11.0, with a maximum at pH 10.5 of 0.11 $\mu\text{mol/min per mg}$ of protein at 25°C. Elsewhere in the range of activity (which extends from pH 6.5 to 11.2) the activity is less than 0.04 $\mu\text{mol/min per mg}$ of protein. In the range pH 6.5–7.5 the enzyme is insensitive to UMP. Above pH 7.5 sensitivity to UMP gradually increases to a maximum at pH 10.0.

Kinetic behaviour has been studied in detail at pH 10.0 and 25°C. In the absence of UMP initial-rate plots are hyperbolic for both substrates (L-aspartate and carbamoyl phosphate). In the presence of UMP kinetic plots for aspartate remain hyperbolic; the inhibition is non-competitive with respect to aspartate. However, in the presence of UMP plots for carbamoyl phosphate become sigmoidal. The degree of sigmoidicity is a function of the UMP concentration; the interaction (Hill)