THE ENZYMATIC TRANSFORMATION OF GALACTOSE INTO GLUCOSE DERIVATIVES

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Extracts of galactose-fermenting yeasts contain the enzyme galactokinase,[1] which catalyzes a transphosphorylation between adenosine triphosphate and galactose. The reaction product galactose-1-phosphate was

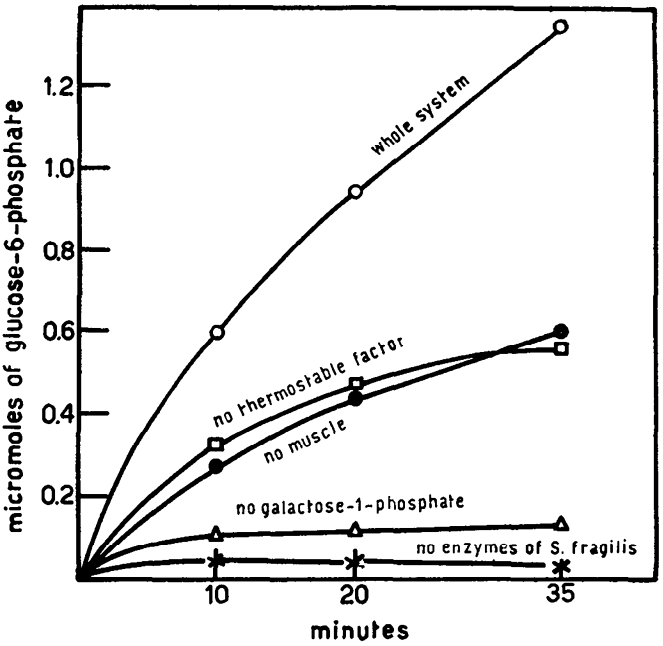

FIG. 1. The transformation of galactose-1-phosphate into glucose-6-phosphate. Whole system, 2 μM of galactose-1-phosphate, 1 μM of $MgSO_4$, 0.03 ml. of partially purified *S. fragilis* enzyme, 0.01 ml. of muscle extract containing phosphoglucomutase, and 0.05 ml. of purified thermostable factor from yeast; total volume, 2.3 ml. The glucose-6-phosphate is measured by its reducing power.[3]

known to be transformed by crude extracts[2] probably to glucose-6-phosphate.

A study of this reaction showed that, when a partially purified enzyme of *Saccharomyces fragilis* was used, two additional factors are necessary for

[1] Trucco, R. E., Caputto, R., Leloir, L. F., and Mittelman, N., *Arch. Biochem.*, **18**, 137 (1948).

[2] Kosterlitz, H. W., *Biochem. J.*, **33**, 1087 (1939). Caputto, R., Leloir, L. F., Trucco, R. E., Cardini, C. E., and Paladini, A., *Arch. Biochem.*, **18**, 201 (1948).

maximum activity (Fig. 1). One is thermolabile and the other thermostable. The thermolabile factor is present in muscle and has been identified with phosphoglucomutase by using this enzyme as purified by Najjar,[4] or yeast extract plus glucose diphosphate.[3, 5] The reaction would be

$$\text{Galactose-1-phosphate} \xrightarrow{(a)} \text{glucose-1-phosphate} \xrightarrow{(b)} \text{glucose-6-phosphate}$$

In the absence of phosphoglucomutase, glucose-1-phosphate accumulates, as may be ascertained by destroying the *S. fragilis* enzyme by heating, adding phosphoglucomutase, and then measuring the glucose-6-phosphate formed.

The thermostable factor has been found to act in reaction (*a*), and is different from glucose diphosphate, which acts in reaction (*b*). This factor is present in mammalian liver and in commercial yeast. It is hoped that its identification will cast some light on the long sought mechanism of the inversion at C_4 in hexoses.

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[4] Najjar, V. A., *J. Biol. Chem.*, **175**, 281 (1948).

[5] Leloir, L. F., Trucco, R. E., Cardini, C. E., Paladini, A., and Caputto, R., *Arch. Biochem.*, **19**, 339 (1948).