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APPENDIX

Relationship Between Amount of Hexokinase and Amount of Phosphate Esterified

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The reactions concerned may be expressed in a simplified form as follows

Reaction (1) represents the rate of synthesis of ATP by the oxidative phosphorylation reaction. Except at very low concentrations of ADP, this is independent of the concentration of ADP (Slater & Holton, 1953). Reaction (2) is the hexokinase reaction; it is assumed that the concentration of ATP is low, so that with saturating concentrations of glucose, the rate of this reaction will be proportional to the concentrations of ATP and to the concentration of hexokinase (hK). Reaction (3) is the ATPase reaction; again it is assumed that the ATP concentration is so low that the rate of reaction (3) is proportional to it. Since the enzymes catalysing reactions (1) and (3) are in the sarcosomal

preparation, the amount of which is not varied, the concentrations of these enzymes are included in the rate constants k_1 and k_3 .

In the steady state,

$$d[\text{ATP}]/dt = k_1 - [\text{ATP}] (k_2[\text{hK}] + k_3) = 0, \quad (4)$$

$$d[\text{HMP}]/dt = v = k_2[\text{hK}] [\text{ATP}]. \quad (5)$$

Adding (4) and (5),

$$v = k_1 - k_3[\text{ATP}]. \quad (6)$$

From (4),

$$[\text{ATP}] = \frac{k_1}{k_2[\text{hK}] + k_3}. \quad (7)$$

Combining (6) and (7)

$$v = k_1 \left[1 - \frac{k_3}{k_2[\text{hK}] + k_3} \right],$$

i.e.

$$v = \frac{k_1 k_2 [\text{hK}]}{k_2[\text{hK}] + k_3},$$

and

$$1/v = \frac{k_2 + k_3[\text{hK}]}{k_1 k_2 [\text{hK}]}.$$

Thus

$$\frac{1}{v} = \frac{1}{k_1} + \frac{k_3}{k_1 k_2} \cdot \frac{1}{[\text{hK}]}. \quad (8)$$

That is, $1/v$ is a linear function of $1/[\text{hK}]$.

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