THE STIMULATORY EFFECT OF CALCIUM UPON THE
SUCCINOXIDASE ACTIVITY OF FRESH RAT TISSUES*

Sirs:

In the course of an investigation concerned with the effect of various vitamin deficiencies upon the succinoxidase content of rat tissues it was observed that the in vitro addition of traces of calcium salts stimulated markedly the activity of this system in certain tissues. A more complete study of this effect has yielded the following results.

Both minced and homogenized tissue suspensions were employed. The rate of oxygen uptake in the presence of succinate was determined in Barcroft differential manometers at 38°. Air was employed as the gas phase and potassium hydroxide was present in the inner wells. The calcium solution was prepared by the reaction of c.p. hydrochloric acid with calcium carbonate of high purity. The preparation of cytochrome c was carried out according to Keilin and Hartree except that it was dialyzed against distilled water instead of 1 per cent sodium chloride. Calcium was determined by a modification of the method of Alten, Weiland, and Knippenberg.

In the absence of added cytochrome c, the succinoxidase activity of minced liver was increased 43 to 80 per cent by the addition of 20 y of calcium. With homogenized liver (40 mg. per flask) the addition of 20 γ of calcium resulted in increases of 93 and 48 per

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cent in the absence and presence of added cytochrome c (3 × 10^{-8} mole per flask) respectively. The succinoxidase activity of homogenized kidney cortex (20 mg. per flask) was stimulated 40 per cent in the presence of added calcium. Added cytochrome c did not affect the magnitude of the stimulatory effect of calcium in this tissue. The most pronounced effect of calcium was observed in the case of homogenized heart tissue (20 mg. per flask) in which the addition of 20 γ of calcium in the presence of 3 × 10^{-8} mole of cytochrome c caused an increase of 200 per cent in the succinoxidase activity.

Under our experimental conditions the addition of 20 γ of calcium always yielded the maximum stimulatory effect. In many cases the addition of smaller amounts of calcium (as little as 1 or 2 γ) resulted in a marked acceleration of succinoxidase activity. An analysis of liver showed it to contain from 100 to 200 γ of total calcium per gm. of fresh tissue. Therefore, 4 to 8 γ of calcium were introduced into each flask as tissue calcium. The combined calcium content of the remaining constituents of the flask other than added calcium was less than 2 γ. In homogenized liver suspensions the addition of aluminum salts in concentrations similar to those of the calcium salt employed had no significant effect upon the succinoxidase activity. In only a few isolated cases was a similar calcium effect observed in brain and skeletal muscle.

The function of calcium in the succinoxidase system and the physiological significance of this calcium effect are under investigation.

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