

NOTES

CITRATE METABOLISM AND CELL PERMEABILITY¹

E. C. FOULKES

The May Institute for Medical Research, Cincinnati, Ohio

Received for publication April 12, 1954

Nonmetabolism of an added substrate by an intact microorganism, as opposed to its ready dissimilation by the same organism after, for instance, mechanical disintegration, is commonly explained by the presence of an impermeable cell wall. That such an assumption is not justified in at least one specific case is shown by the following experiments.

The distribution of citrate added to a suspension of fresh bakers' yeast was studied. One ml of 0.02 M sodium citrate was added to 20 ml of a 50 per cent (w/v) suspension of fresh or treated yeast. The suspension was shaken for 30 minutes at 0 C. The citrate content of both the supernatant and the cells was determined then after acidification and boiling. From the dilution of citrate the volume of water was calculated into which the citrate could freely permeate (citrate space). There was no evidence of citrate adsorption. A simultaneous experiment was carried out at 37 C to determine whether any citrate was metabolized. Some typical results are summarized in table 1.

The total extracellular water as determined by the distribution of chloride under identical conditions was 12.9 ml. It is clear from these results that in the fresh suspension citrate is restricted to the extracellular water. On freezing

¹ This work was supported by funds from the JCR-Libson Fellowship.

the cell becomes freely permeable to citrate but remains incapable of metabolizing it. The nonmetabolism of citrate cannot be attributed to enzyme inactivation as it is metabolized readily upon subsequent treatment of the cells with chloroform. The freezing neither alters the cell volume nor greatly affects the ability of the cell

TABLE 1

TREATMENT	CITRATE SPACE AT 0 C		CITRATE METABOLIZED AT 37 C
	ml	per cent of total H ₂ O	
Control.....	12.1	66	0
Cells frozen twice at -20 C.....	18.2	100	0.6
Cells frozen as above, then exposed to 0.1 ml CHCl ₃	18.2	100	14.0

to maintain a high intracellular potassium and low sodium level against a concentration gradient. The endogenous citrate in both fresh and frozen cells is nondiffusible and is not metabolized.

The conclusion can be drawn that impermeability of the cell wall is not sufficient explanation for the inability of whole yeast cells to metabolize citrate.

THE GROWTH OF AN "OBLIGATE" THERMOPHILIC BACTERIUM AT 36 C

L. LEON CAMPBELL, JR.¹

Department of Bacteriology, University of Texas, Austin, Texas

Received for publication April 28, 1954

Campbell and Williams (*J. Bacteriol.*, **65**, 141, 1953; *J. Bacteriol.*, **65**, 146, 1953) have re-

¹ Research Fellow of the National Institutes of Health, 1951-1952. Present address: Department of Horticulture, Washington State College, Pullman, Washington.

ported on the effect of incubation temperatures on the nutritional requirements of a large number of facultative and obligate thermophilic bacteria. During the course of the investigation it was noted that one culture of *Bacillus stearothermophilus*, strain 2184-2, which was labeled as