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THE SEQUENCE OF HEXOSES IN SUCROSE SYNTHESIS BY PLANTS

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The Sequence of Hexoses in Sucrose

Synthesis by Plants

A. A. Benson

March 12, 1951

Berkeley, California

THE SEQUENCE OF HEXOSES IN SUCROSE SYNTHESIS BY PLANTS¹

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University of California, Berkeley

March 12, 1951

It has been concluded by Aronoff and Vernon (1) that the mechanism of sucrose synthesis in soy bean leaves differs markedly from that previously reported (2) with Chlorella, Scenedesmus and barley leaves. Results obtained in this laboratory are consistent with some of the observations, such as the earlier uniform labeling of the fructose moiety of sucrose, reported by Aronoff and Vernon. However, other evidence presented by these authors suggested prior synthesis of the glucose of sucrose. Although a sequence of reactions similar to the reversal of glycolysis could conceivably result in prior labeling of the glucose moiety, there is as yet no reason to suspect such a unique system of reactions.

We have repeated our earlier experiments with soy bean leaves (var. Hawkeye) and find labeling of fructose phosphates and the fructose moiety of sucrose prior to that of glucose compounds. As in algae, barley and geranium, no appreciable amounts of free trioses or hexoses are obtained

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without enzymatic hydrolysis of phosphate esters. The ratio of fructose to glucose radioactivity in sucrose was found to be 1.8 in 30 Sec. PS Chlorella, 3.0 in 15 Sec. PS barley, 3.3 in 15 Sec. PS soy bean leaf and 1.05 in 60 Sec. soy bean leaf. The ratio of fructose phosphates to glucose phosphates was 1.0 in 5 Sec. PS Scenedesmus, 0.3 in 60 Sec. PS Scenedesmus, 14 in 2 Sec. PS barley, 0.3 in 30 Sec. PS barley, 5 in 5 Sec. PS soy bean, 0.8 in 15 Sec. PS soy bean and 0.8 in 60 Sec. PS soy bean. The prior appearance of C¹⁴ in fructose phosphates is in accord with its early predominance in the fructose of sucrose.

The general pattern of compounds and the similarity of the kinetics of their synthesis strongly suggests that hexoses are formed by the same pathways in most plants. Although their formation from phosphoglyceric acid by the precise reversal of glycolysis is open to question, it appears that three-carbon compounds are condensed to form ketoses rather than glucose.

REFERENCES

- (1) Aronoff and Vernon, Arch. Biochem. 28 424 (1950).
- (2) Calvin et al., Soc. Exptl. Biol. Monograph No. 4
"Carbon Dioxide Fixation" (1950).

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