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BIOSYNTHESIS OF GLYCOGEN FROM URIDINE DIPHOSPHATE GLUCOSE [1]

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Previous work has shown that UDPG [2] acts as glucose donor in the synthesis of trehalose phosphate [3], sucrose [4], sucrose phosphate [5] and cellulose [6].

TABLE I

Analytical Changes

The complete system contained: 0.5μ mole of UDPG, 0.33 μmole of glycogen, tris-(hydroxymethyl) -aminomethane buffer of *p*H 7.4, 0.01 *M* ethylenediaminetetraacetate and 0.02 ml. of enzyme. Total volume 0.07 ml. Incubation: 45 min. at 37°. The enzyme was prepared from an aqueous extract of rat liver by acidification to *p*H 5. The precipitate was washed four times with acetate buffer of *p*H 5 and redissolved in buffer. Results in μmoles.

	Δ UDP (a)	Δ glycogen
Complete system	0.22	0.27
No UDPG	0	− 0.03

a Estimated with pyruvate kinase 7. *b* Measured with a phenol-sulfuric acid reagent after precipitation with ethanol 8 and expressed as glucose.

When UDPG is incubated with a liver enzyme and a small amount of glycogen the chemical changes shown in Table I were found to take place. Approximately equal amounts of UDP and of glycogen were formed. Such an increase in glycogen could only be detected with liver preparations freed from amylase. Other preparations obtained by ammonium sulfate precipitation contained amylase and therefore lost their glycogen. With such enzymes no UDP formation took place unless a primer was added. As shown in Table II glycogen and soluble starch acted as primers whereas glucose and maltose were ineffective. Several mono-, di- and oligosaccharides and hexose phosphates were tested with negative results. Treatment of glycogen with α-amylase destroyed its priming capacity. It can be concluded that UDPG acts directly as a glucose donor to glycogen and that the reaction is thus similar to polysaccharide formation from glucose 1-phosphate with animal phosphorylase which requires a primer of high molecular weight. The enzyme was found in the soluble fraction of liver and became very unstable after purification.

TABLE II

Primer Requirement

System as in Table I, but glycogen omitted. The enzyme (0.01 ml.) was obtained by precipitation with 1.6 *M* ammonium sulfate followed by dialysis. Incubated 60 min. at 37°.

Additions	Δ UDP (μmoles)
None	0
0.1 mg. glucose	0
0.2 mg. maltose	0
0.4 mg. glycogen	0.08
0.4 mg. soluble starch	0.06

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2 UDPG = uridine diphosphate glucose; UDP = uridine diphosphate.

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