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Prenol Phosphates and Mannosyltransferases

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The role of undecaprenol phosphate–sugars as lipid-soluble intermediates in the biosynthesis of bacterial wall polymers is well established (Osborn, 1969). Evidence implying that prenol phosphate–sugars have a similar role in the biosynthesis of polysaccharides of plant cell walls and also of mammalian glycoproteins has been reported (Villemez & Clark, 1969; Kauss, 1969; Caccam, Jackson & Eylar, 1969). Strong evidence that dolichol phosphate–glucose is an intermediate in the transfer of glucose from UDP-glucose to glycoprotein in pig liver has been published (Behrens & Leloir, 1970). We have studied the response to different prenol phosphates of mannoyltransferase activities, from GDP-mannose, in mammalian, plant and fungal systems and report some of the results here.

Monophosphates of pig liver dolichols-17 to -21 (Butterworth & Hemming, 1968), of betulaprenols-6 to -9 (Wellburn & Hemming, 1966), of solanesol, of ficaprenols-10 to -13 (Stone, Wellburn, Hemming & Pennock, 1967), of farnesol and of cetyl alcohol were prepared chemically (Behrens & Leloir, 1970) and purified by chromatography on DEAE-cellulose (Lahav, Chiu & Lennarz, 1969).

The incorporation of [^{14}C]mannose from GDP-[U-^{14}C]mannose into lipid-soluble products was studied by using the endoplasmic reticulum of pig liver. The isolation of the cell fraction and incubation conditions were essentially as described by Caccam *et al.* (1969) for studies on the incorporation of mannose into glycoproteins of rabbit liver. In a typical experiment, without addition of prenol phosphate, 10% of the added ^{14}C was recovered as lipid. At a concentration of 178μM, the phosphates of the pig liver dolichols and of the betulaprenols produced fourfold increases in this figure, solanesyl phosphate threefold, the phosphates of the ficaprenols twofold and those of farnesol and of cetyl alcohol no increase. With the dolichyl phosphates and betulaprenyl phosphates the effect was maximal at 5 min. This was followed by a gradual decrease over the next 2h accompanied by a steady rise in the ^{14}C associated with protein.

Whereas in the control only one ^{14}C-labelled lipid could be detected, in the presence of phosphates of the dolichols, betulaprenols, solanesol and ficaprenols a second ^{14}C-labelled lipid was also formed. The relative ^{14}C content of the two lipids varied with time. Acid (pH 2, 100°C, 10 min) liberated completely the [^{14}C]mannose from both lipids.

A particulate fraction from mung-bean seedlings that is capable of transferring mannose from GDP-mannose to cell-wall polysaccharides (Villemez & Clark, 1969) was also studied. In a typical experiment the incorporation of ^{14}C into lipid from GDP-[U-^{14}C]mannose was 4.5% and this increased threefold in the presence of the dolichols and betulaprenols but did not increase in the presence of the other compounds (all at 264μM). Two ^{14}C-labelled lipids were produced in the presence of the dolichols and betulaprenols both of which liberated [^{14}C]mannose on treatment with dilute acid.

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