During N-linked glycosylation of proteins, oligosaccharide chains are assembled on the carrier molecule dolichyl pyrophosphate in the following order: 2 molecules of N-acetylglucosamine, 9 molecules of mannose, and 3 molecules of glucose. These 14-residue oligosaccharide cores are then transferred to asparagine residues on nascent polypeptide chains in the endoplasmic reticulum. As proteins progress through the Golgi apparatus, the oligosaccharide cores are modified by trimming and extension to generate a diverse array of glycosylated proteins.Alg5p is a transmembranedolichyl-phosphate beta-glucosyltransferase that adds glucose to dolichyl-phosphateon the cytoplasmic side of the endoplasmic reticulum. Dol-P then reverses orientation, flipping glucose into the lumen of the ER, where it serves as a source of glucose for growing lipid-linked oligosaccharides. Mutants lacking ALG5 accumulate LLO's with nine mannose moieties--but no glucose moieties--which are transferred to proteins with reduced efficiency; alg5 mutants have no apparent growth defect. Dpm1p performs an analogous function for mannose, which is also transported into the ER via Dol-P. Loss of either ALG5 or ALG6, which adds the first glucose moiety to LLO's, causes the accumulation of Man9 LLO's; this phenotype is shared with the human congenital disorder of glycosylation CDG-Ic, which is due to mutations in hALG6, not hALG5. hALG5 and hALG6 appear to be coordinately expressed. Trichomonas vaginalis has several homologous copies of ALG5, but lacks a DPM1 homolog.