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.Cax4p converts dolichyl pyrophosphateto dolichyl phosphatein the lumen of the ER, possibly to recycle Dol-P-P; Dol-P-P is the byproduct of the transfer of a LLO to a protein, and Dol-P is the substrate on the cytosolic side of the ER on which many of the early reactions in N-linked glycosylation occur. Cells lacking Cax4p grow slowly, exhibit decreased levels of N-linked glycosylation--although those LLO's that are synthesized are full-length--and accumulate Dol-P-P. They have an anomalous cell wall and are sensitive to Calcofluor white, hygromycin B, and FK506and resistant to vanadate. Overexpression of RER2, SEC59, or LPP1--which generate Dol-P through other pathways--partially suppresses the cax4 phenotype. Mutation of CAX4 causes a synthetic lethal interaction with calmodulinand exhibits defective actin organization. The mouse CAX4 homolog DOLPP1 complements deletion of CAX4.