Transport of proteins from the endoplasmic reticulumto the Golgi is mediated by COPII vesicles. The COPII vesicle coat is minimally comprised of 5 subunits: the GTPase Sar1p, the Sec23p-Sec24p heterodimer, and the Sec13p-Sec31p complex. COPII vesicle coats can also contain heterodimers of Sec23p complexed with either of the Sec24p homologs, Sfb2p or Sfb3p. In S. cerevisiae, COPII vesicle formation occurs throughout the ER. In most other eukaryotes, COPII vesicle-mediated protein export is localized to specialized regions termed transitional ERor ER exit sites.COPII vesicle formation requires the assembly of the COPII vesicle coat and cargo selection and is regulated by cycles of GTP hydrolysis. The GTP exchange factorSec12p, an ER membrane protein, activates Sar1p by exchanging GDP for GTP. Sar1p-GTP recruits the Sec23p-Sec24p heterodimer. Sec23p is a GTPase activating proteinfor the Sar1p GTPase activity. Sec24p, Sfb2p, and Sfb3p, are involved in cargo selection. Sar1p, the Sec23p-Sec24p heterodimer, and cargo form the prebudding complex. Improper cargo selection results in GTP hydrolysis and diassembly of the prebudding complex. However, once the pre-budding complex is assembled, Sec13p and Sec31p polymerize to form the outer layer or scaffold of the COPII vesicle coat. The Sec13p-Sec31p complex further stimulates the GTPase activity of Sar1p.Although Sar1p, Sec23p, Sec24p, Sec13p, and Sec31p are necessary and sufficient for vesicle formation, additional factors such as Sec16p and Sed4p are also involved in this process. Through interactions with other COPII proteins, Sec16p is thought to facilitate the assembly of the vesicle coat by stabilizing the pre-budding complexwhile Sed4p regulates the vesicle budding process by stimulating the GTPase activity of Sar1p.Mutations in genes involved in COPII vesicle formation are also impaired in other processes such as ERADand autophagy, suggesting that ER to the Golgi transport is a prerequisite for these processes to occur.Mutations in the human homolog of SEC23, Sec23A, cause the autosomal recessive disorder Cranio-lenticulo sutural dysplasia, while mutation of Sar1B, one of the two human isoforms of S. cerevisiae Sar1p, cause defects in lipoprotein metabolism including the diseases that are known as the chylomicron retention diseases.