**1:** A schematic drawing of the secretory and endocytic pathways is presented below. Indicate which component in the drawing (A to J) corresponds to each of the following. Your answer would be a 10-letter string composed of letters A to J only, e.g. HICDJABFGE.

() Early endosome

() Late endosome

() ER

() Lysosome

() cis Golgi cisterna

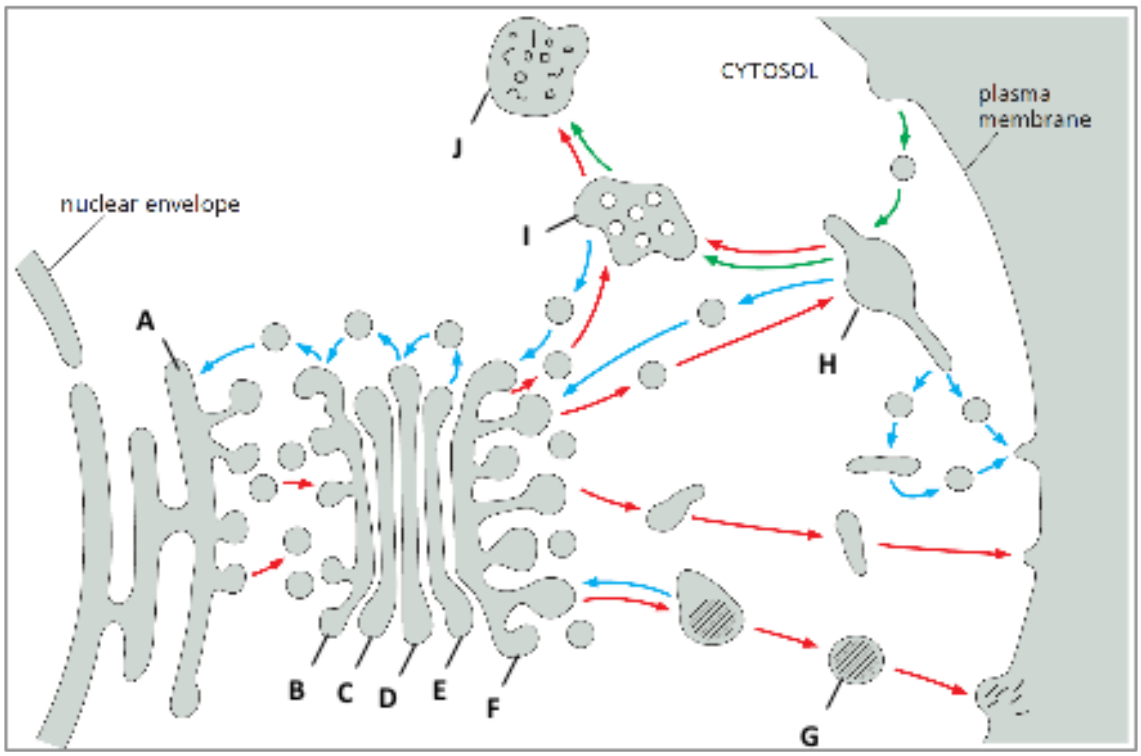
() medial Golgi cisterna

() trans Golgi cisterna

() cis Golgi network (CGN)

() trans Golgi network (TGN)

() Secretory vesicle



**2:** Indicate whether each of the following descriptions better applies to COPI- (1), COPII- (2), or Clathrin- (3) coated vesicles. Your answer would be a four- digit number composed of digits 1 to 3 only, e.g. 1322.

() They mediate transport from the ER to the cis Golgi network.

() Their coat protein forms a three-legged structure called a triskelion.

() They are pinched off from their donor compartment by a dynamin collar.

() They are involved in retrograde transport in the Golgi apparatus.

**3:** Indicate true (T) and false (F) statements below regarding glycosylation of proteins in the endoplasmic reticulum and the Golgi apparatus. Your answer would be a four-letter string composed of letters T and F only, e.g. TTTF.

() Glycosylation can promote protein folding.

() The glycosylation state of a protein can determines its fate along the secretory pathway.

() Glycosylation makes a protein more accessible to proteases and other proteins.

() Glycosylated proteins are generally more flexible.

**4:** Explain how an mRNA molecule can remain attached to the ER mem- brane while the individual ribosomes translating it are released and rejoin the cytosolic pool of ribosomes after each round of translation.

**5:** Examine the multipass transmembrane protein shown in **Figure 12–19**. What would you predict would be the effect of converting the first hydrophobic transmembrane segment to a hydrophilic segment? Sketch the arrangement of the modified protein in the ER membrane.

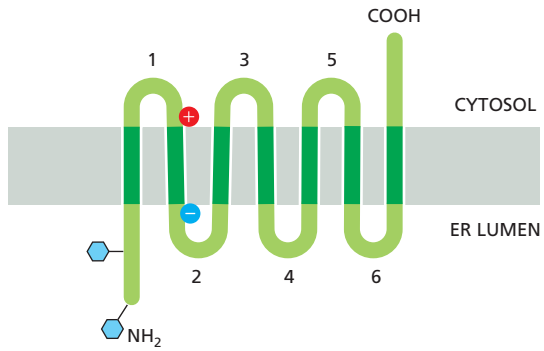



Figure 12–19 Arrangement of a multipass transmembrane protein in the ER membrane (Problem 12–102). *Blue hexagons* represent covalently attached oligosaccharides. The positions of positively and negatively charged amino acids flanking the second transmembrane segment are shown.

**6:** Why might it be advantageous to add a preassembled block of 14 sugars to a protein in the ER, rather than building the sugar chains step-by-step on the surface of the protein by the sequential addition of sugars by individual enzymes?

**7:** Outline the steps by which misfolded proteins in the ER trigger synthesis of additional ER chaperone proteins. How does this response benefit the cell?

**8:** All new phospholipids are added to the cytosolic leaflet of the ER membrane, yet the ER membrane has a symmetrical distribution of different phospholipids in its two leaflets. By contrast, the plasma membrane, which receives all its membrane components ultimately from the ER, has a very asymmetrical distribution of phospholipids in the two leaflets of its lipid bilayer. How is the symmetry generated in the ER membrane, and how is the asymmetry generated and maintained in the plasma membrane?

**9:** Decide whether each of these statements is true or false, and then explain why.

A: The signal peptide binds to a hydrophobic site on the ribosome causing a pause in protein synthesis, which resumes when SRP binds to the signal peptide.

B: Nascent polypeptide chains are transferred across the ER membrane through a pore in the Sec61 protein translocator complex.

C: In multipass transmembrane proteins, the odd-numbered transmembrane segments (counting from the N-terminus) act as start-transfer signals and the even-numbered segments act as stop-transfer signals.

D: The ER lumen contains a mixture of thiol-containing reducing agents that prevent the formation of S–S linkages (disulfide bonds) by maintaining the cysteine side chains of luminal proteins in reduced (–SH) form.

**10.** The Clathrin coat on a vesicle is made up of numerous triskelions that form a cage 60–200 nm in diameter, composed of both pentagonal and hexagonal faces, just like C60 fullerene (**Figure 13–2**). Sketch the location of an individual triskelion in the Clathrin-coated vesicle in Figure 13–2B.

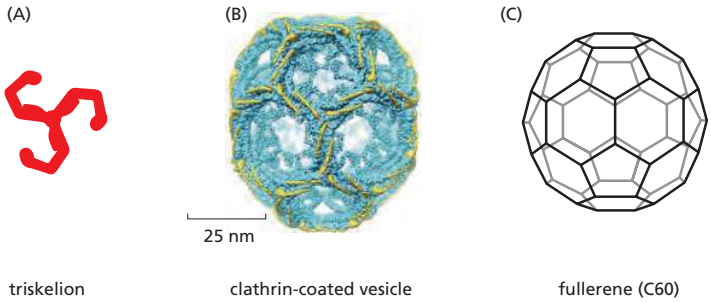



**Figure 13–2** Structure of a clathrin coat (Problem 13–18). (A) A triskelion subunit. (B) A clathrin-coated vesicle. (C) A C60 fullerene.

**11:** Yeast, and many other organisms, make a single type of Clathrin heavy chain and a single type of Clathrin light chain; thus, they make a single kind of Clathrin coat. How is it, then, that a single Clathrin coat can be used for three different transport pathways—Golgi to late endosomes, plasma membrane to early endosomes, and immature secretory vesicles to Golgi—that each involves different specialized cargo proteins?

**12:** You have isolated a transmembrane protein which has a GPI anchor and O-linked glycosylation. What is the order of these post-translational modifications? Explain why.