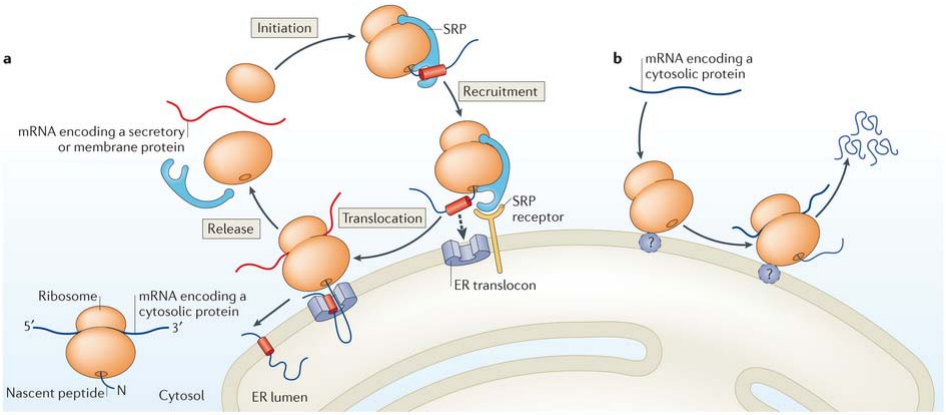
# Trafficking: exo and endocytosis (lectures 3 and 4)

Peter Thorn

## Aims

1. Overview of intracellular trafficking
2. Processing in the endoplasmic reticulum
3. Progression through the Golgi: mechanisms of vesicle budding
4. Regulated secretion and EXOCYTOSIS
5. Regulated secretion and ENDOCYTOSIS

1. Overview of intracellular trafficking: translation




SRP: signal recognition particle

**TABLE 15–3 SOME TYPICAL SIGNAL SEQUENCES**

| FUNCTION OF SIGNAL | EXAMPLE OF SIGNAL SEQUENCE |
|---|---|
| Import into ER | $^{+}H_3N$-Met-Met-Ser-Phe-Val-Ser-Leu-Leu-Leu-Val-Gly-Ile-Leu-Phe-Trp-Ala-Thr-Glu-Ala-Glu-Gln-Leu-Thr-Lys-Cys-Glu-Val-Phe-Gln- |
| Retention in lumen of ER | -Lys-Asp-Glu-Leu-$COO^{-}$ |
| Import into mitochondria | $^{+}H_3N$-Met-Leu-Ser-Leu-Arg-Gln-Ser-Ile-Arg-Phe-Phe-Lys-Pro-Ala-Thr-Arg-Thr-Leu-Cys-Ser-Ser-Arg-Tyr-Leu-Leu- |
| Import into nucleus | -Pro-Pro-Lys-Lys-Lys-Arg-Lys-Val- |
| Import into peroxisomes | -Ser-Lys-Leu- |

Positively charged amino acids are shown in *red*, and negatively charged amino acids in *blue*. An extended block of hydrophobic amino acids is shown in *green*. $^{+}H_3N$ indicates the N-terminus of a protein; $COO^{-}$ indicates the C-terminus. The ER retention signal is commonly referred to by its single-letter amino acid abbreviation, KDEL.

Table 15-3 Essential Cell Biology 3/e (© Garland Science 2010)

1. Overview of intracellular trafficking: routes through the cell

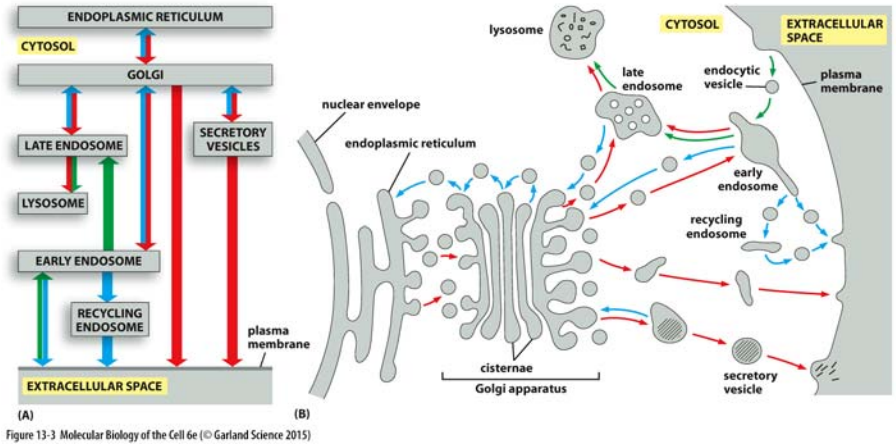
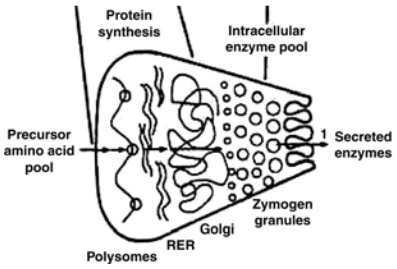
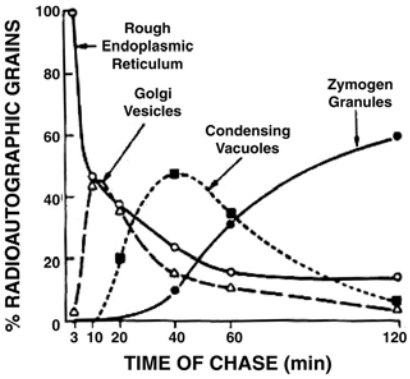


Figure 13-3 Molecular Biology of the Cell 6e (© Garland Science 2015)

1. Overview of intracellular trafficking: time-course

Pulse-chase with radio-labelled amino acids




Jamieson and Palade

1. Overview of intracellular trafficking: principles of translocation

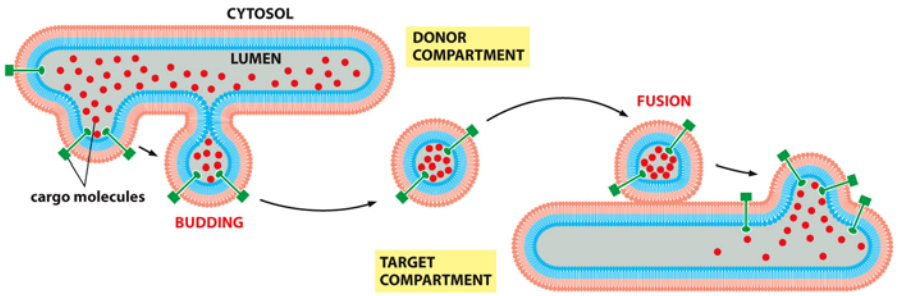



Figure 13-2 Molecular Biology of the Cell 6e (© Garland Science 2015)

1. Overview of intracellular trafficking

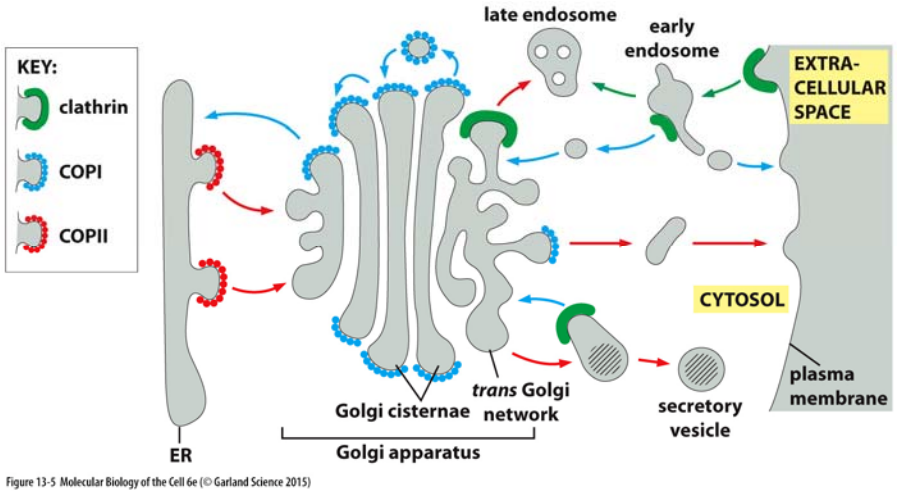



Figure 13-5 Molecular Biology of the Cell 6e (© Garland Science 2015)

1. Overview of intracellular trafficking

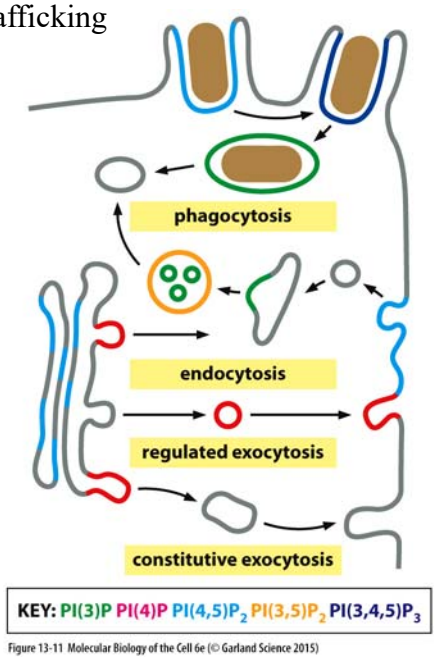


Figure 13-11 Molecular Biology of the Cell 6e (© Garland Science 2015)

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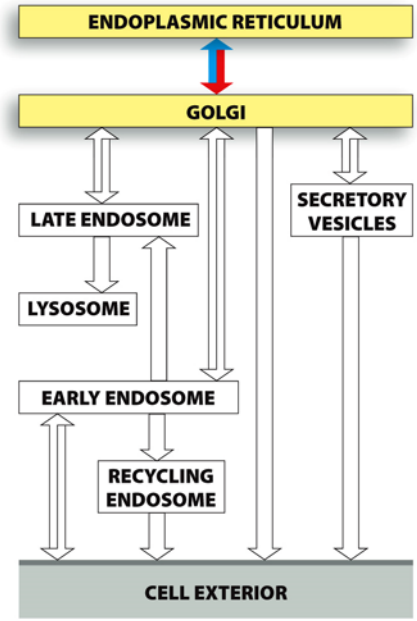
1. Overview of intracellular trafficking
2. **Processing in the endoplasmic reticulum**
3. Progression through the Golgi: mechanisms of vesicle budding
4. Regulated secretion and EXOCYTOSIS
5. Regulated secretion and ENDOCYTOSIS

2. Processing in the endoplasmic reticulum

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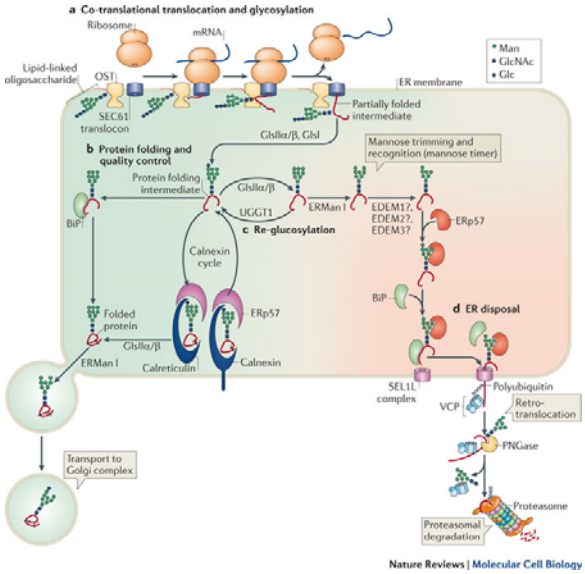
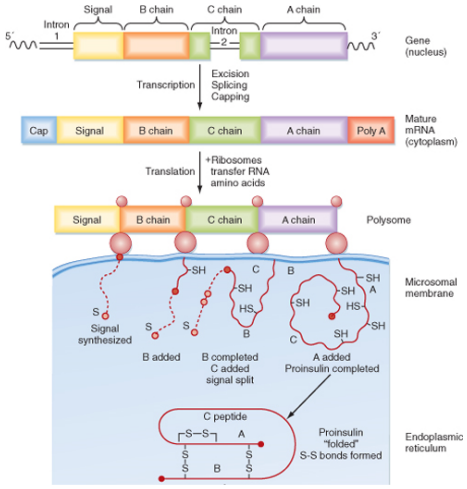
2. Processing in the endoplasmic reticulum



2. Processing in the endoplasmic reticulum: insulin



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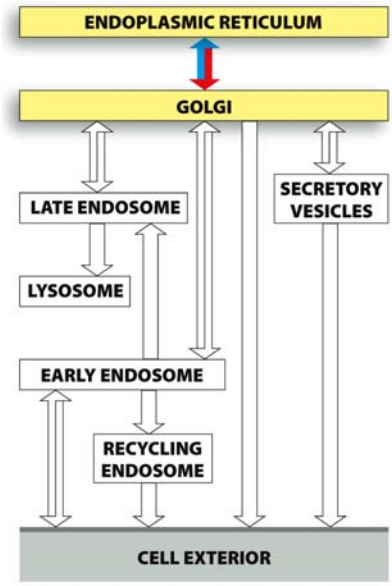
3. Progression through the Golgi: mechanisms of vesicle budding

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3. Progression through the Golgi: mechanisms of vesicle budding

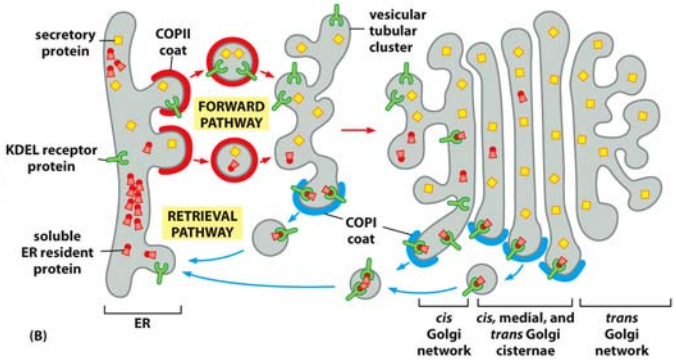



Figure 13-25 Molecular Biology of the Cell 6e (© Garland Science 2015)

3. Progression through the Golgi: mechanisms of vesicle budding

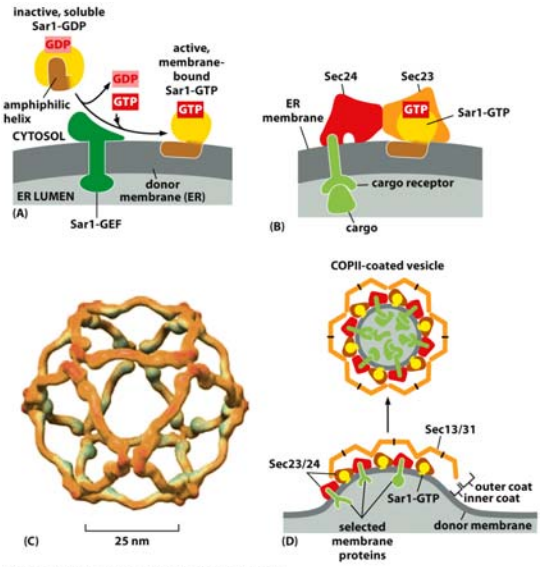



Figure 13-14 Molecular Biology of the Cell 6e (© Garland Science 2015)

3. Progression through the Golgi: mechanisms of vesicle budding

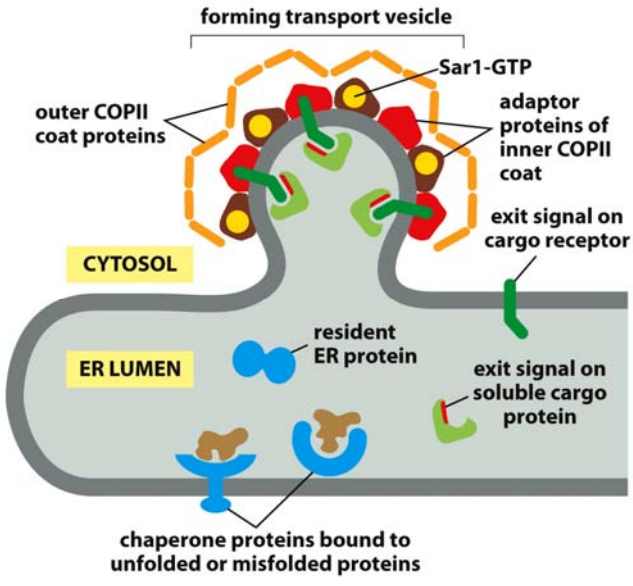
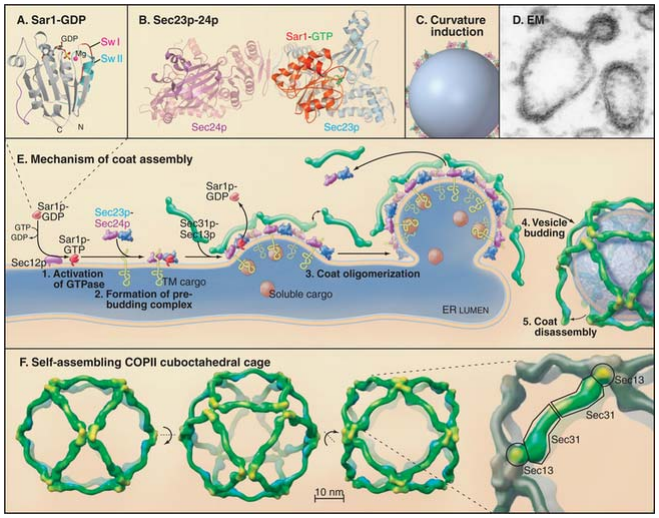
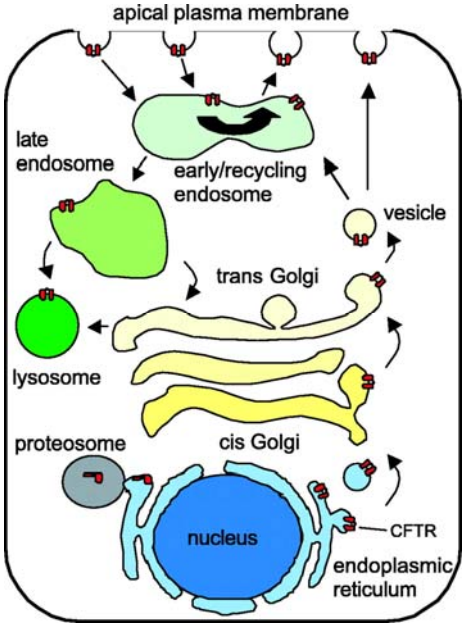



Figure 13-22 Molecular Biology of the Cell 6e (© Garland Science 2015)




https://www.youtube.com/watch?v=ABGlD1vQG3s&spfreload=5

3. Progression through the Golgi: mechanisms of vesicle budding: CFTR

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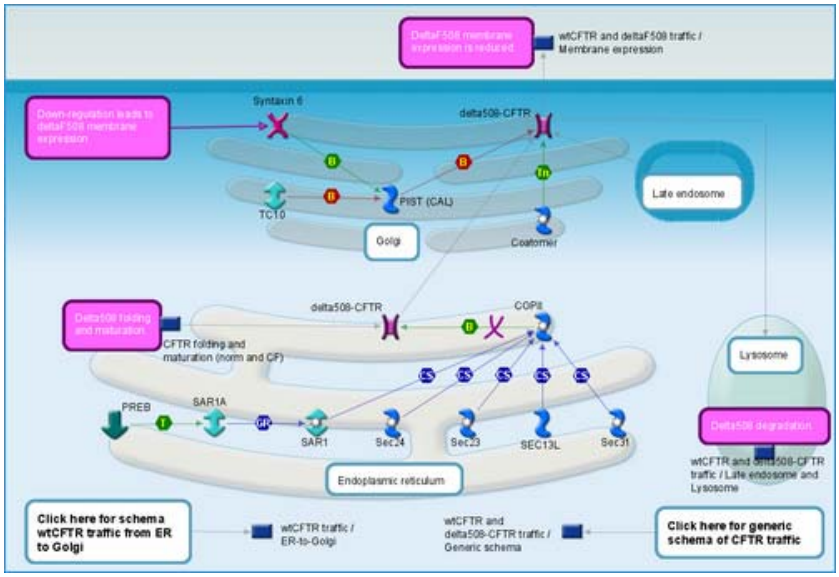

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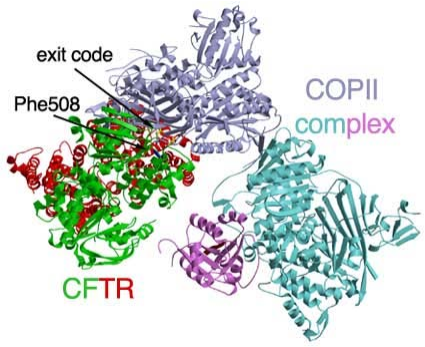



3. Progression through the Golgi

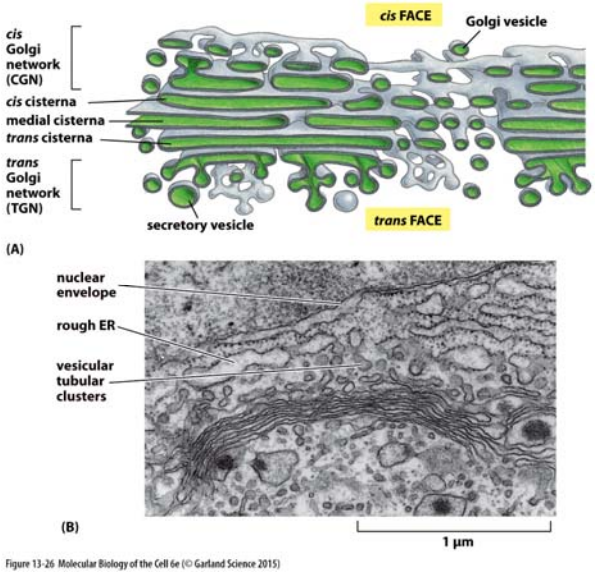



Figure 13-26 Molecular Biology of the Cell 6e (© Garland Science 2015)

3. Progression through the Golgi

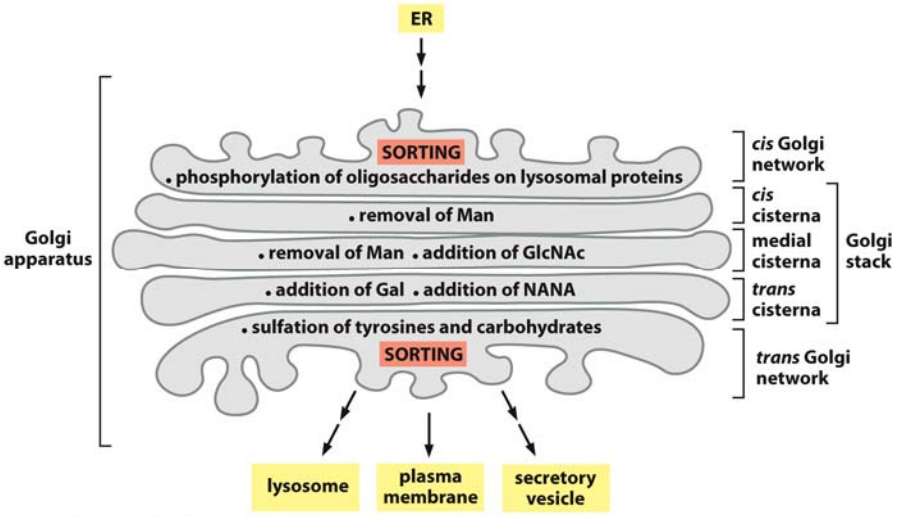



Figure 13-29 Molecular Biology of the Cell 6e (© Garland Science 2015)

3. Progression through the Golgi

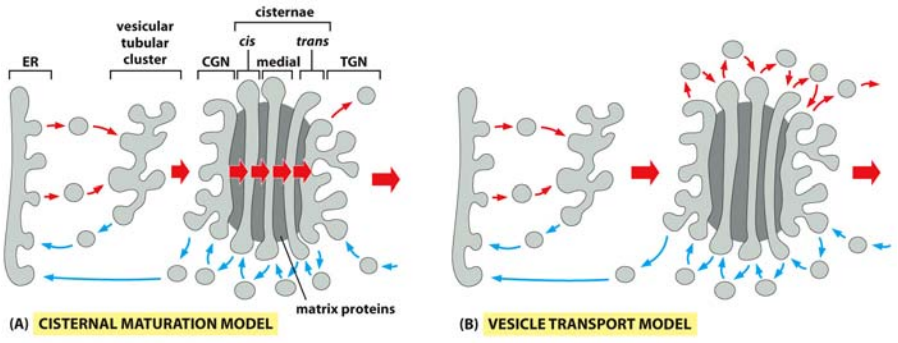
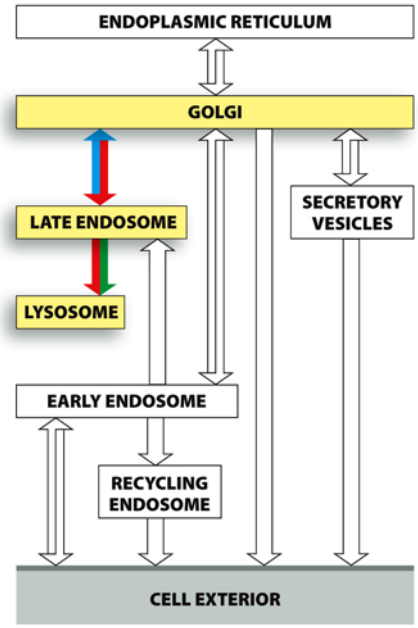



Figure 13-35 Molecular Biology of the Cell 6e (© Garland Science 2015)

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Late endosomes and lysomsomes

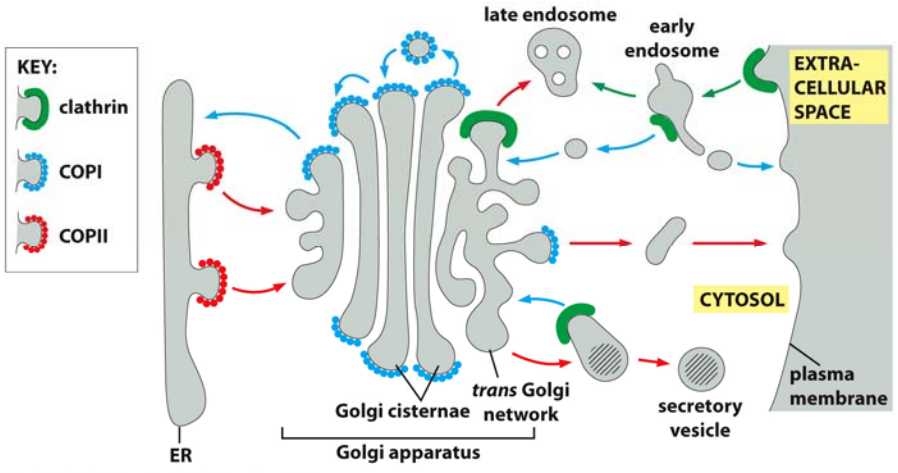
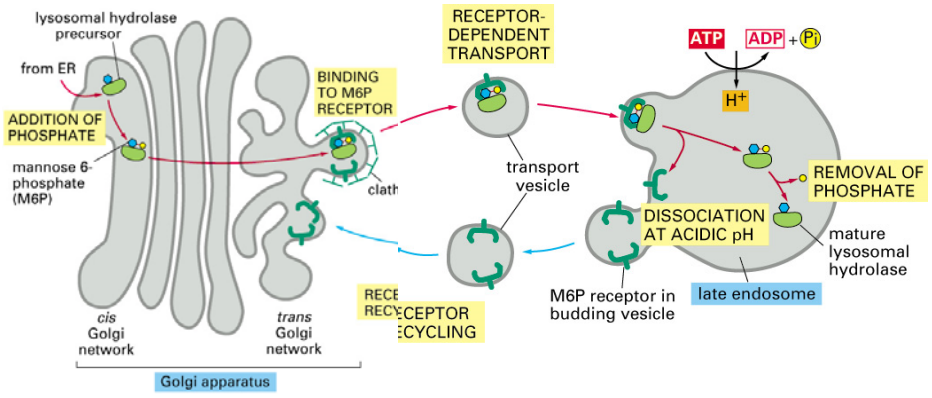



Figure 13-5 Molecular Biology of the Cell 6e (© Garland Science 2015)

## The transport of newly synthesized lysosomal hydrolases to lysosomes



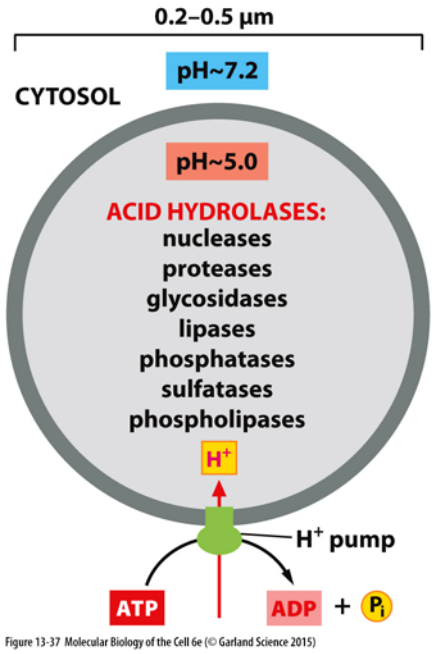




Figure 13-37 Molecular Biology of the Cell 6e (© Garland Science 2015)

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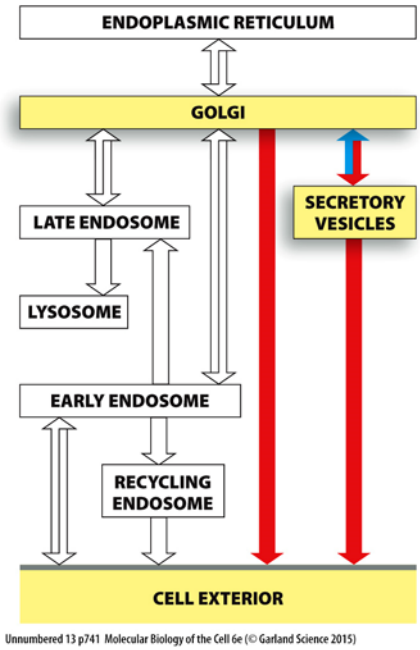


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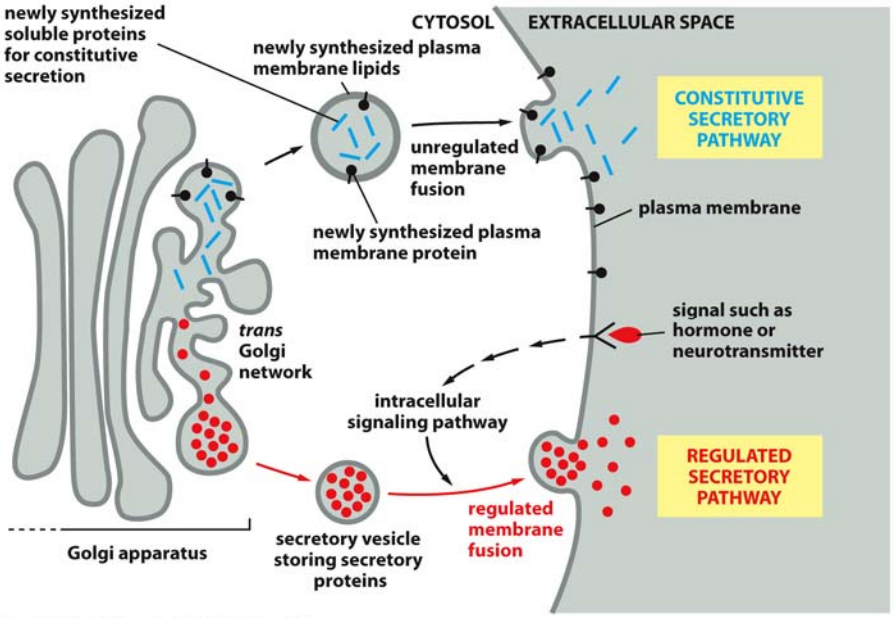



Figure 13-62 Molecular Biology of the Cell 6e (© Garland Science 2015)

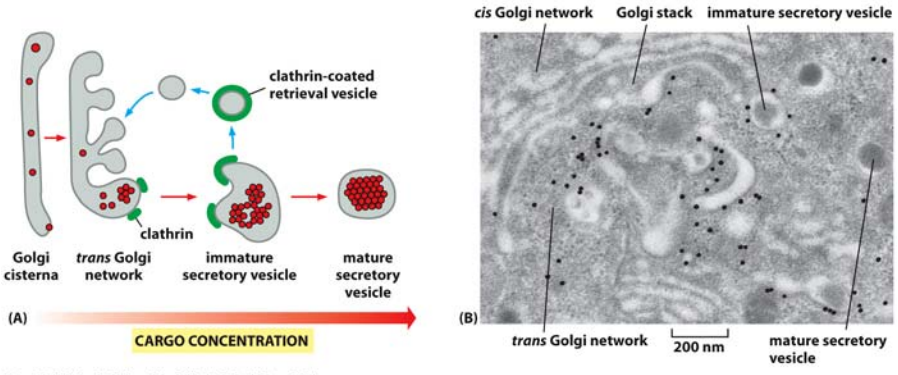



Figure 13-64 Molecular Biology of the Cell 6e (© Garland Science 2015)

ZnT8
Zinc transporter

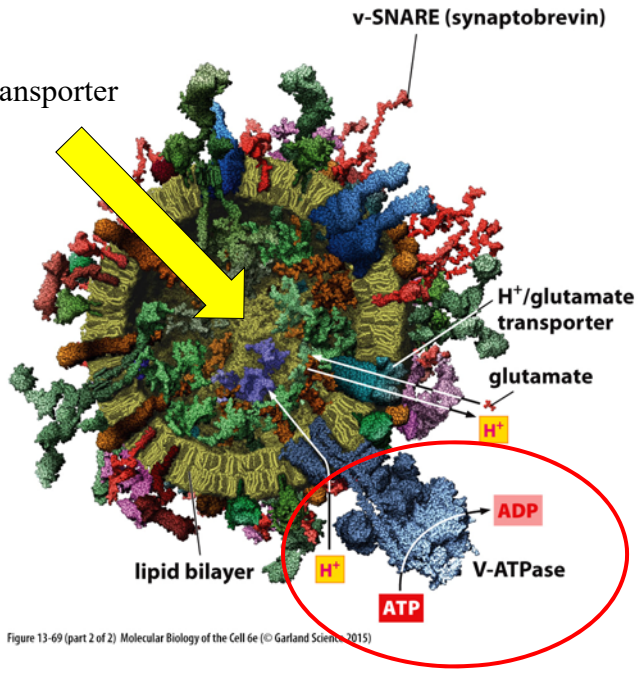
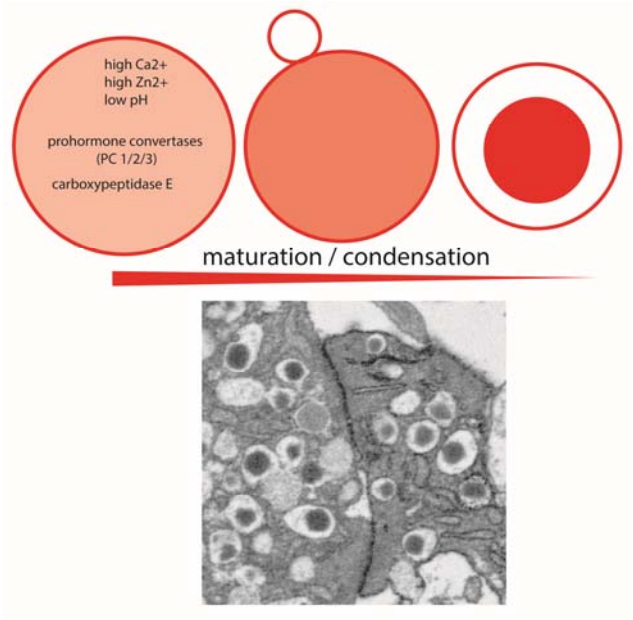



Figure 13-69 (part 2 of 2) Molecular Biology of the Cell 6e (© Garland Science 2015)



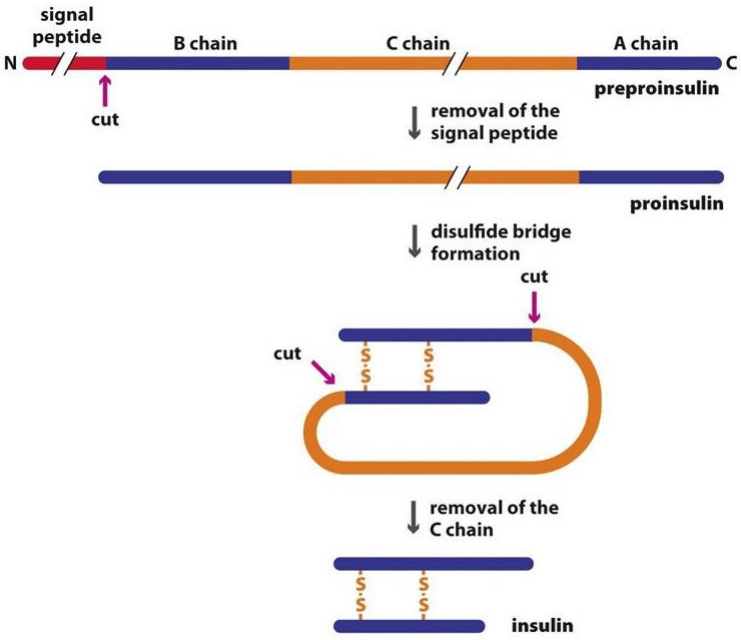



Figure 8.24 Introduction to Genetics (© Garland Science 2012)

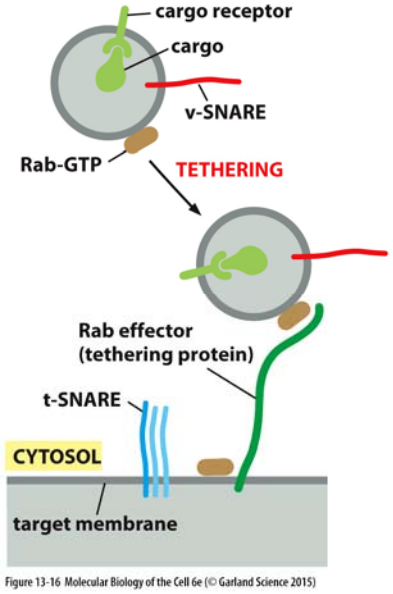



Figure 13-16 Molecular Biology of the Cell 6e (© Garland Science 2015)

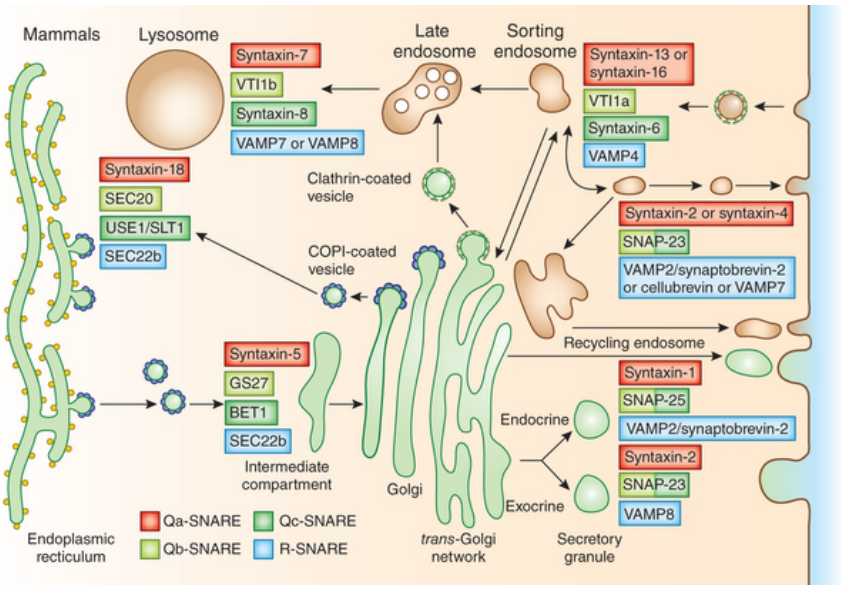
Rab specificity

**TABLE 13–1 Subcellular Locations of Some Rab Proteins**

| Protein | Organelle |
|---|---|
| Rab1 | ER and Golgi complex |
| Rab2 | *cis* Golgi network |
| Rab3A | Synaptic vesicles, secretory vesicles |
| Rab4/Rab11 | Recycling endosomes |
| Rab5 | Early endosomes, plasma membrane, clathrin-coated vesicles |
| Rab6 | Medial and *trans* Golgi |
| Rab7 | Late endosomes |
| Rab8 | Cilia |
| Rab9 | Late endosomes, *trans* Golgi |

Table 13-1 Molecular Biology of the Cell 6e (© Garland Science 2015)

SNARE specificity



SNARE mechanisms of membrane fusion

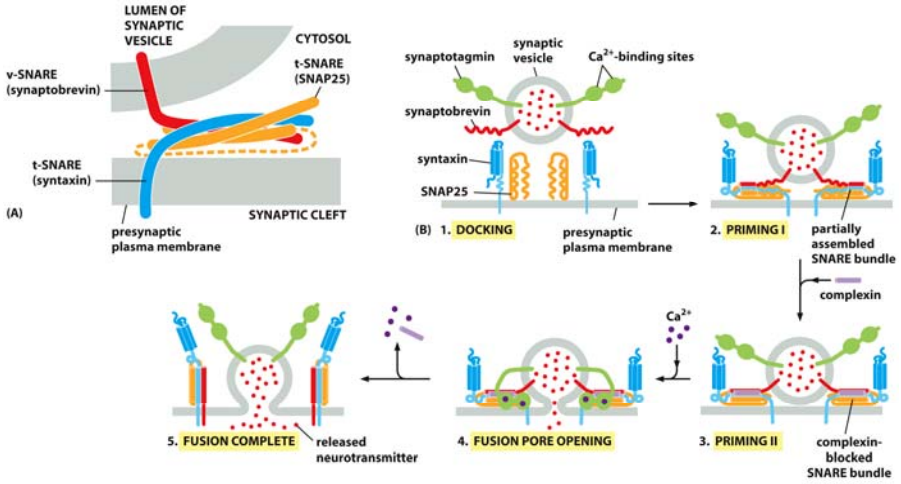



Figure 13-67 Molecular Biology of the Cell 6e (© Garland Science 2015)

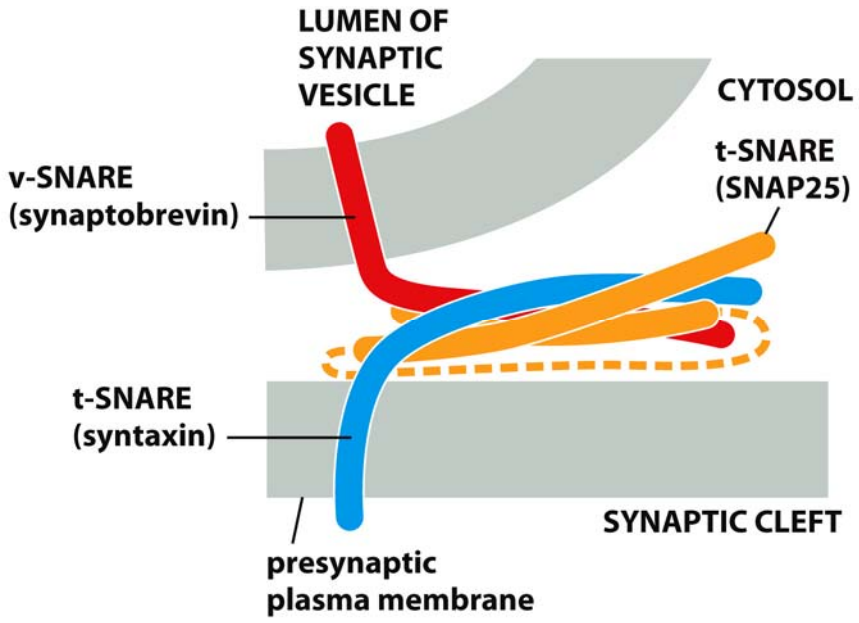



Figure 13-67a Molecular Biology of the Cell 6e (© Garland Science 2015)

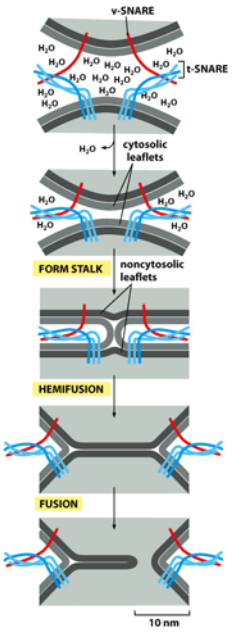



Figure 13-19 Molecular Biology of the Cell 6e (© Garland Science 2015)

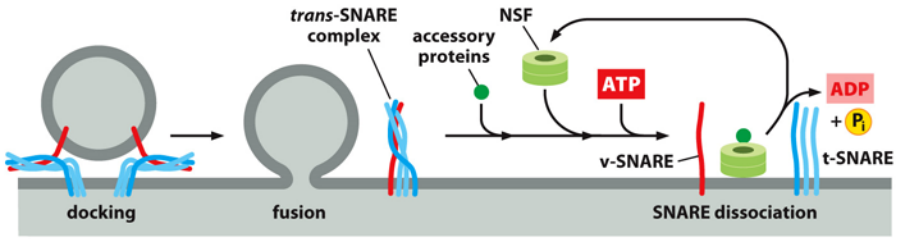
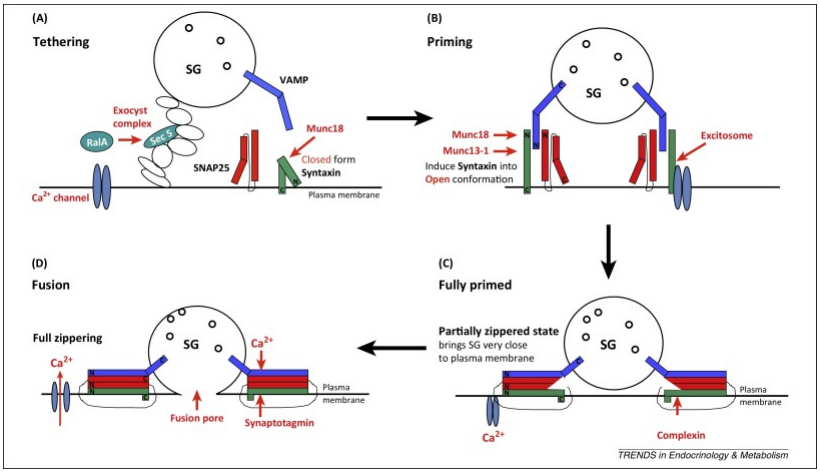
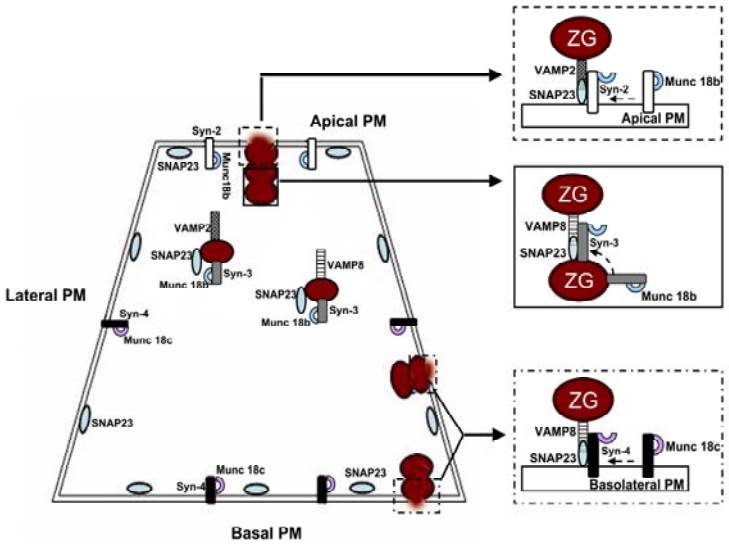



Figure 13-20 Molecular Biology of the Cell 6e (© Garland Science 2015)

Beta cell SNARES




SNARE specificity in acinar cells



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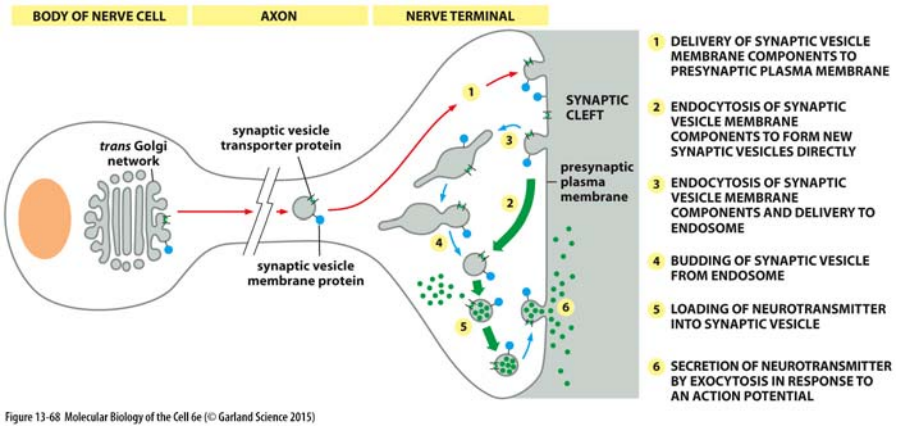

Figure 13-68 Molecular Biology of the Cell 6e (© Garland Science 2015)

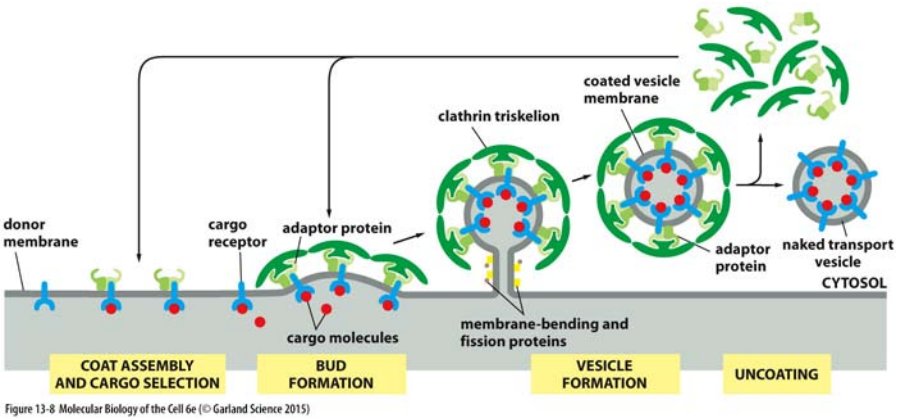


Figure 13-8 Molecular Biology of the Cell 6e (© Garland Science 2015)

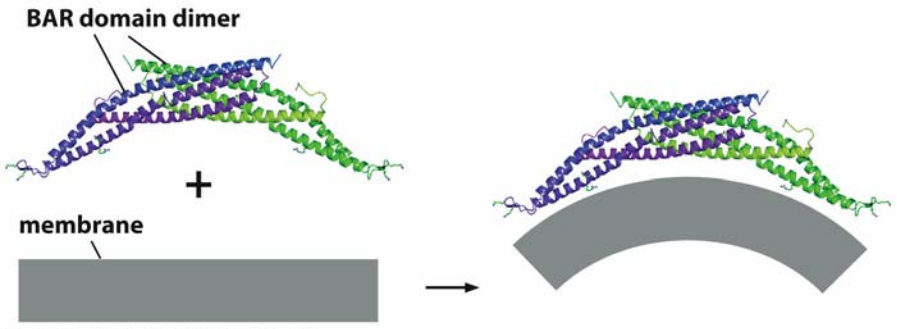


Figure 13-12 Molecular Biology of the Cell 6e (© Garland Science 2015)

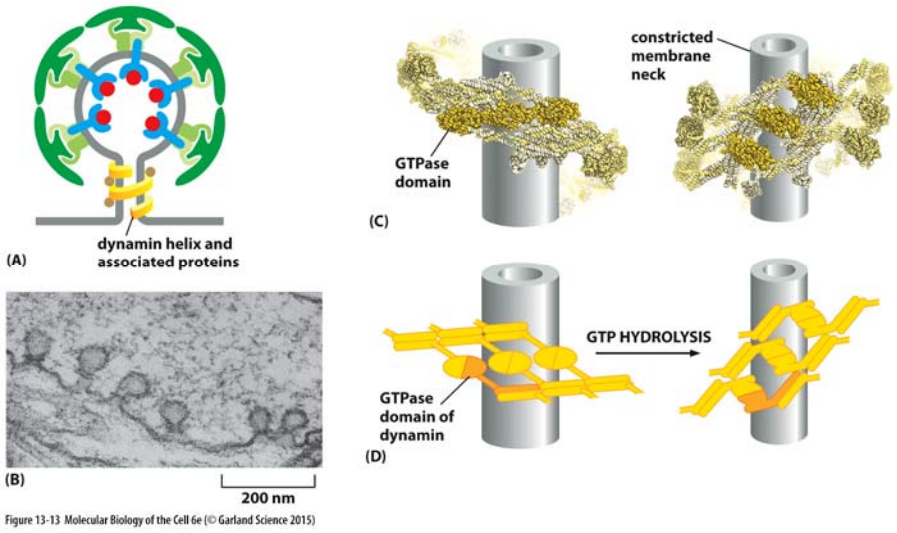


Figure 13-13 Molecular Biology of the Cell 6e (© Garland Science 2015)

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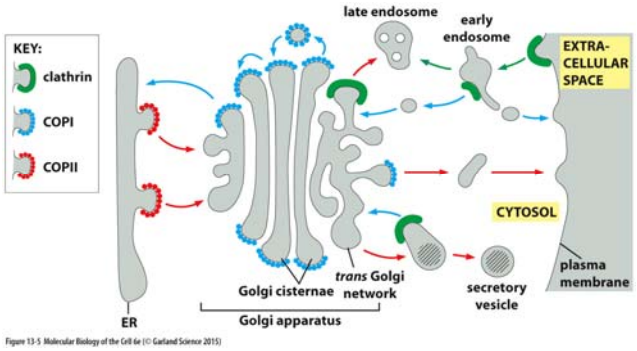


Figure 13-5 Molecular Biology of the Cell 6e (© Garland Science 2015)