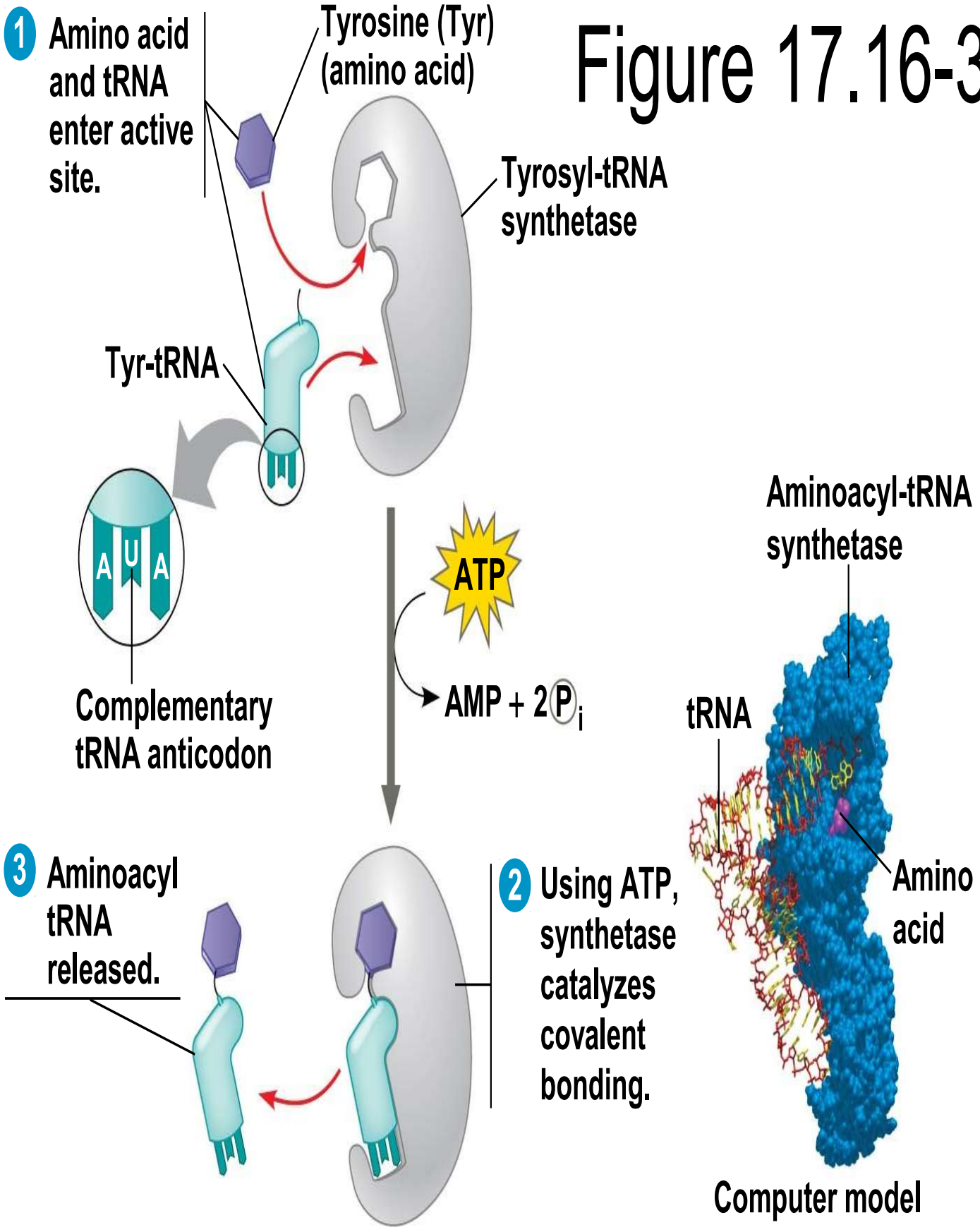


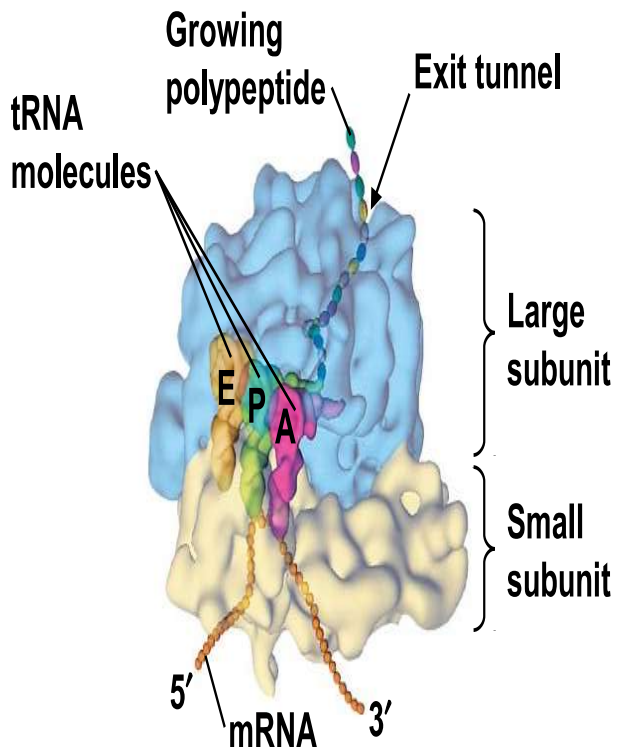
Figure 17.16-3



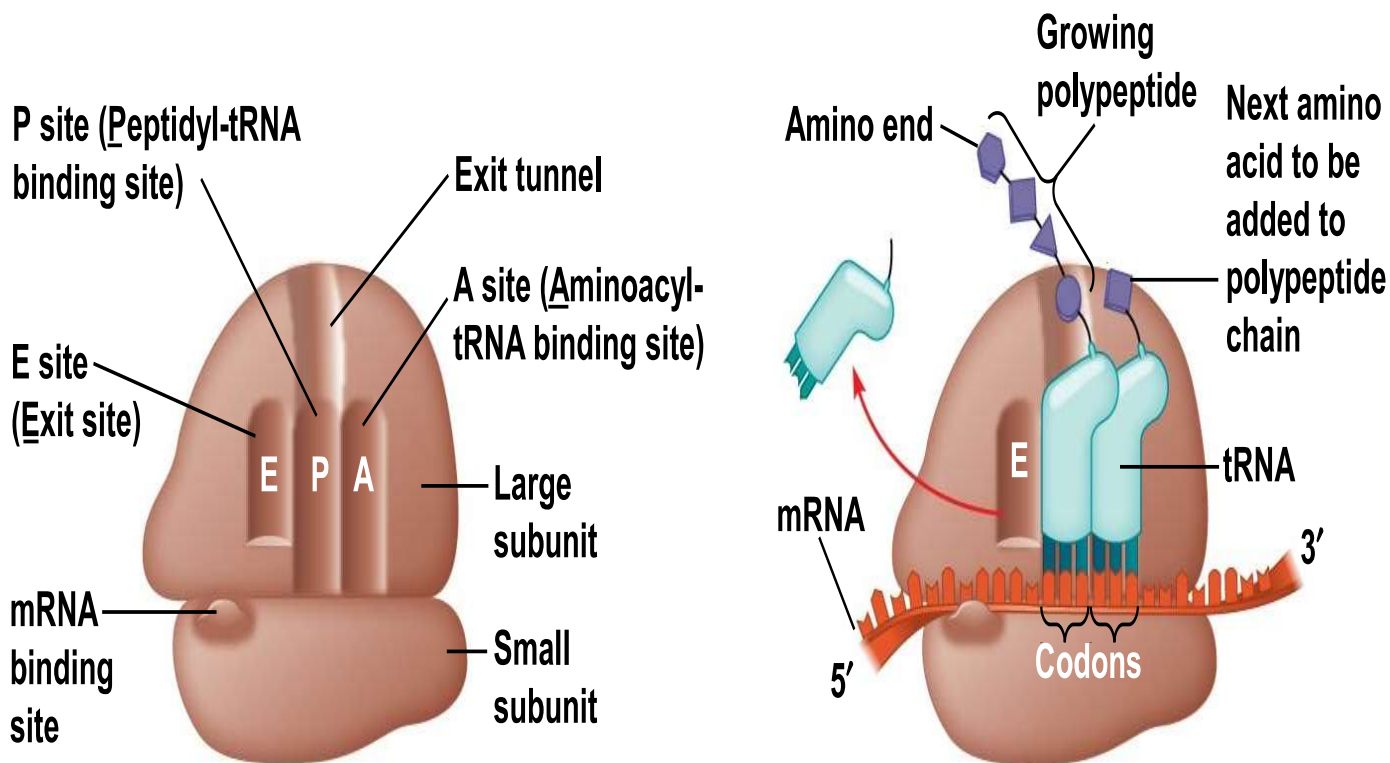
Ribosomes

- **Ribosomes** facilitate specific coupling of tRNA anticodons with mRNA codons in protein synthesis
- The two ribosomal subunits (large and small) are made of proteins and ribosomal RNA (rRNA)

Figure 17.17



(a) Computer model of functioning ribosome



(b) Schematic model showing binding sites

(c) Schematic model with mRNA and tRNA

- A ribosome has three binding sites for tRNA:
 - The **P site** holds the tRNA that carries the growing polypeptide chain
 - The **A site** holds the tRNA that carries the next amino acid to be added to the chain
 - The **E site** is the exit site, where uncharged tRNAs leave the ribosome

Building a Polypeptide

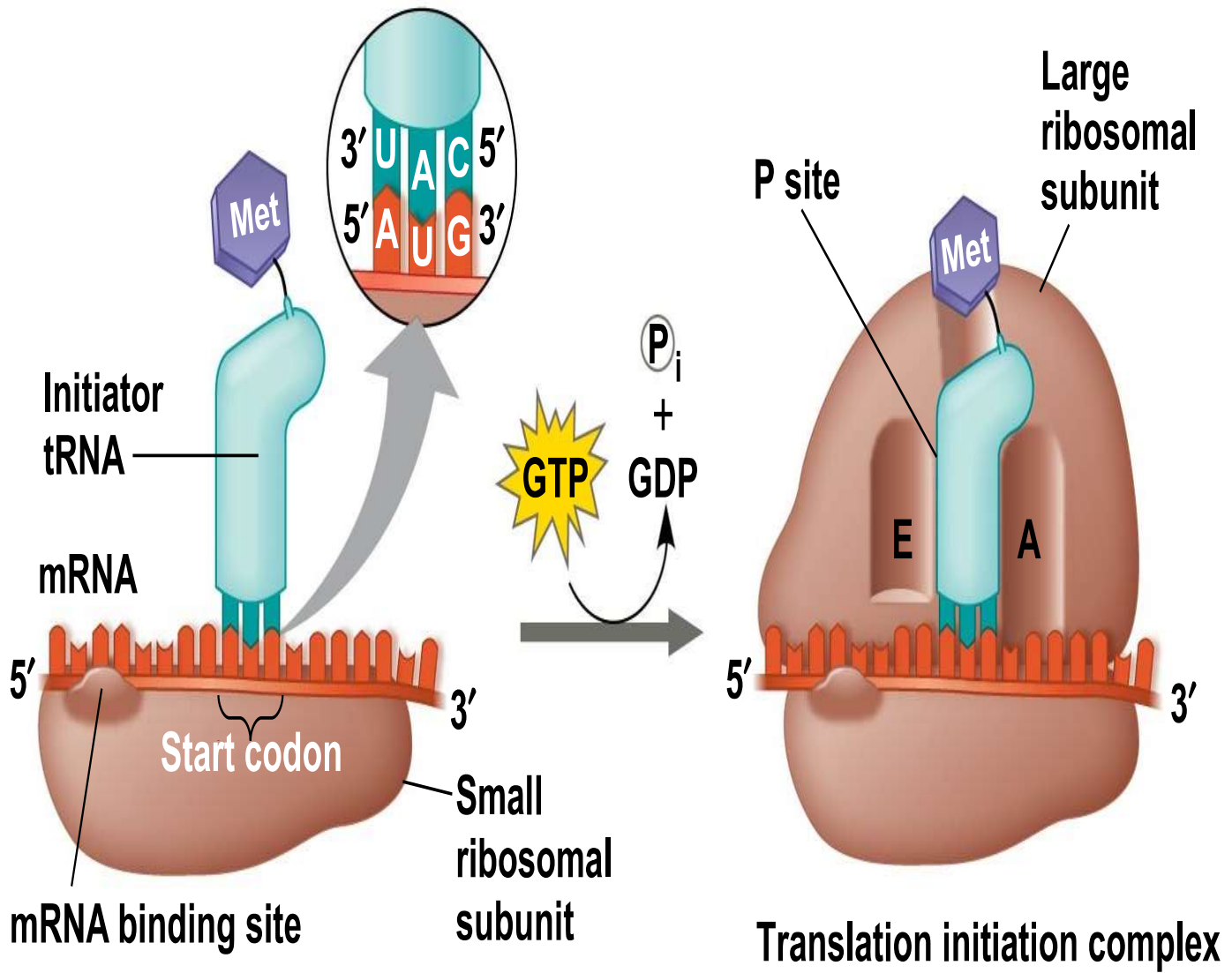
- The three stages of translation:
 - Initiation
 - Elongation
 - Termination

- All 3 stages require protein factors and some require energy in the form of GTP.

Ribosome Association and Initiation of Translation

- Initiation brings together mRNA, a tRNA with the first amino acid, and the two ribosomal subunits
- First, a small ribosomal subunit binds with mRNA and a special initiator tRNA
- Then the small subunit moves along the mRNA until it reaches the start codon (AUG)
- Proteins called initiation factors bring in the large subunit that completes the translation initiation complex

Figure 17.18



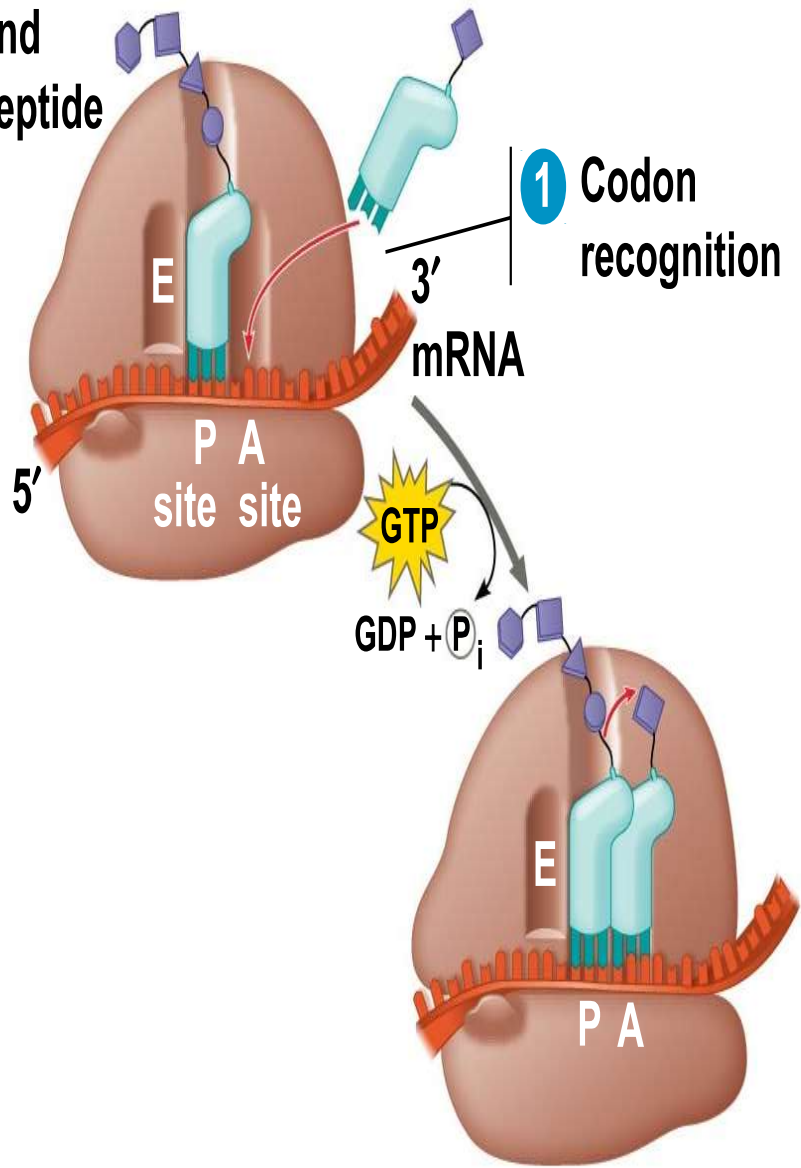
1 Small ribosomal subunit binds to mRNA.

2 Large ribosomal subunit completes the initiation complex.

Elongation of the Polypeptide Chain

- During elongation, amino acids are added one by one to the C-terminus of the growing chain
- Each addition involves proteins called elongation factors and occurs in three steps: codon recognition, peptide bond formation, and translocation
- Energy expenditure occurs in the first (docking in A site) and third steps(translocation)
- Translation proceeds along the mRNA in a 5' → 3' direction

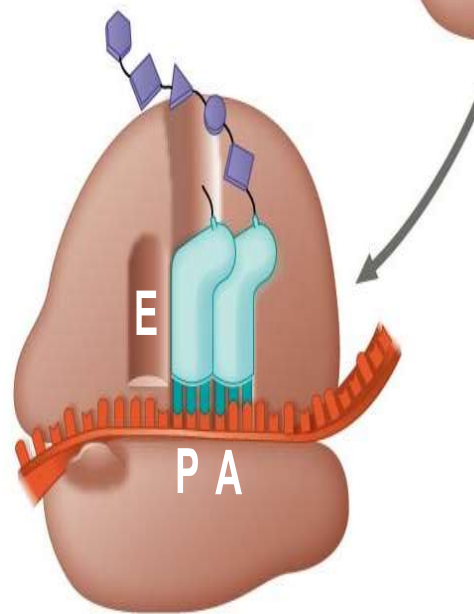
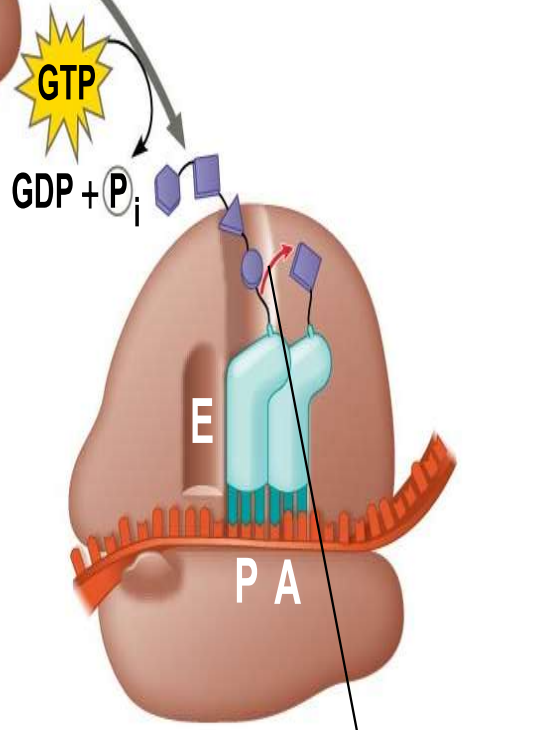
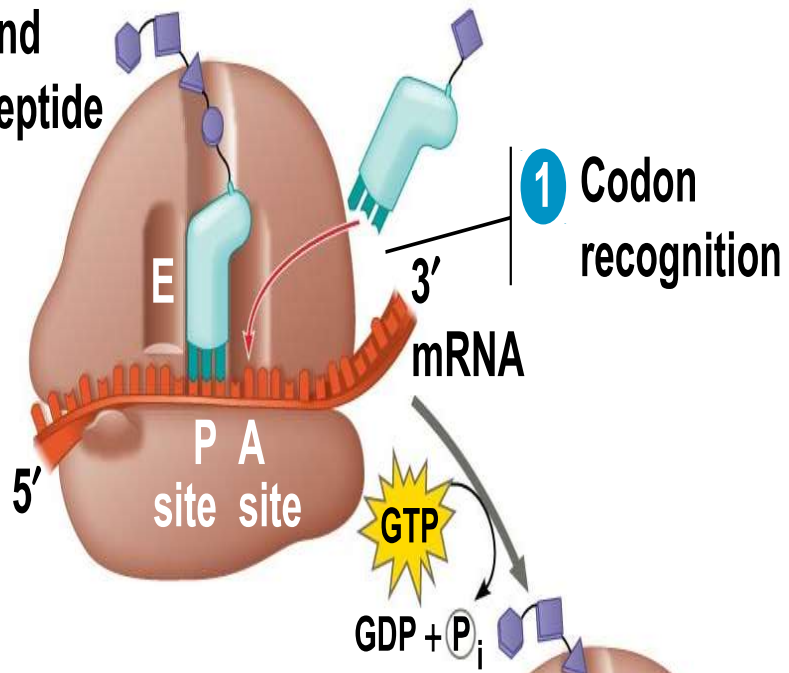
Amino end
of polypeptide

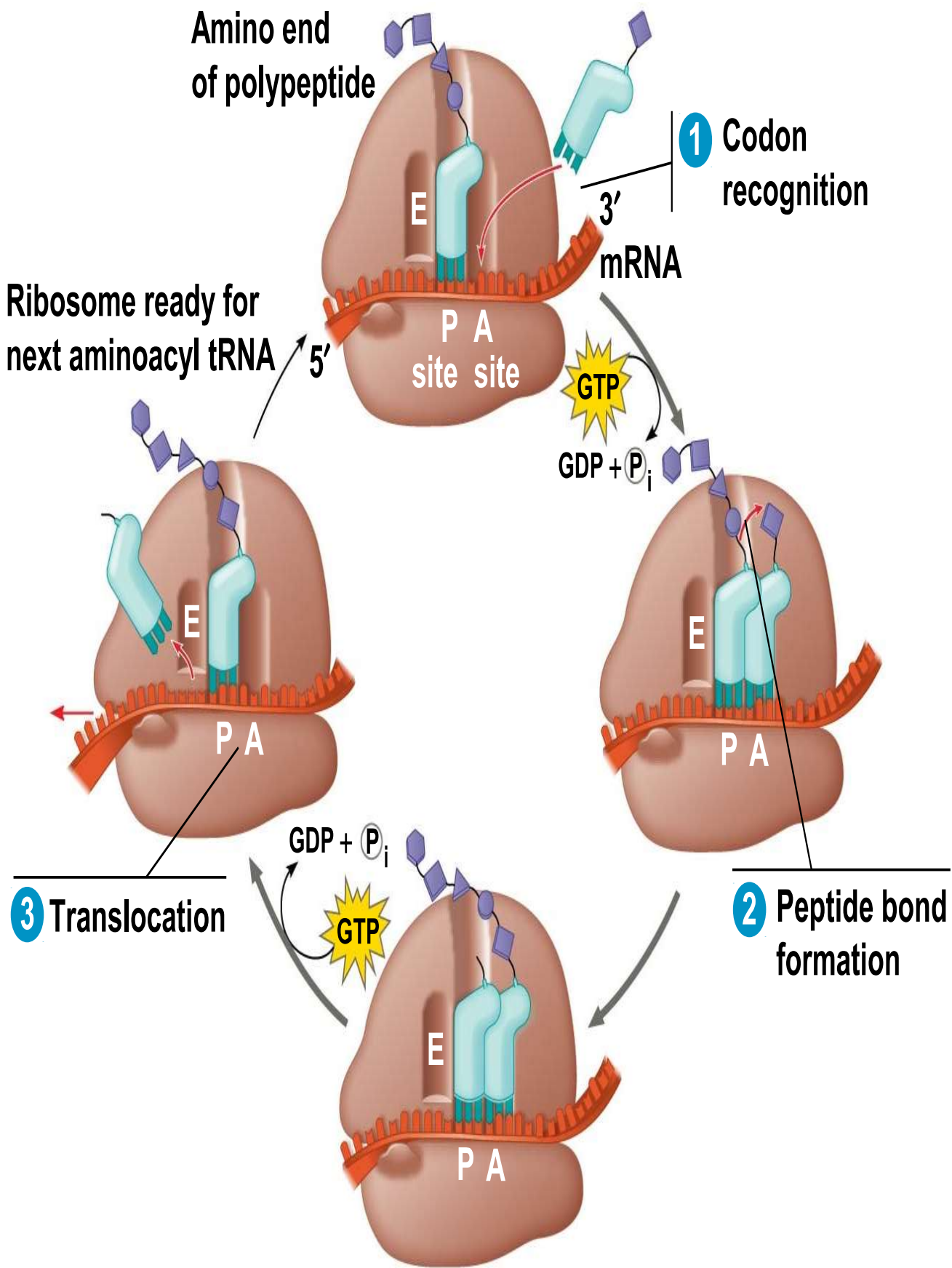


1 Codon
recognition

GTP
GDP + P_i

Amino end
of polypeptide

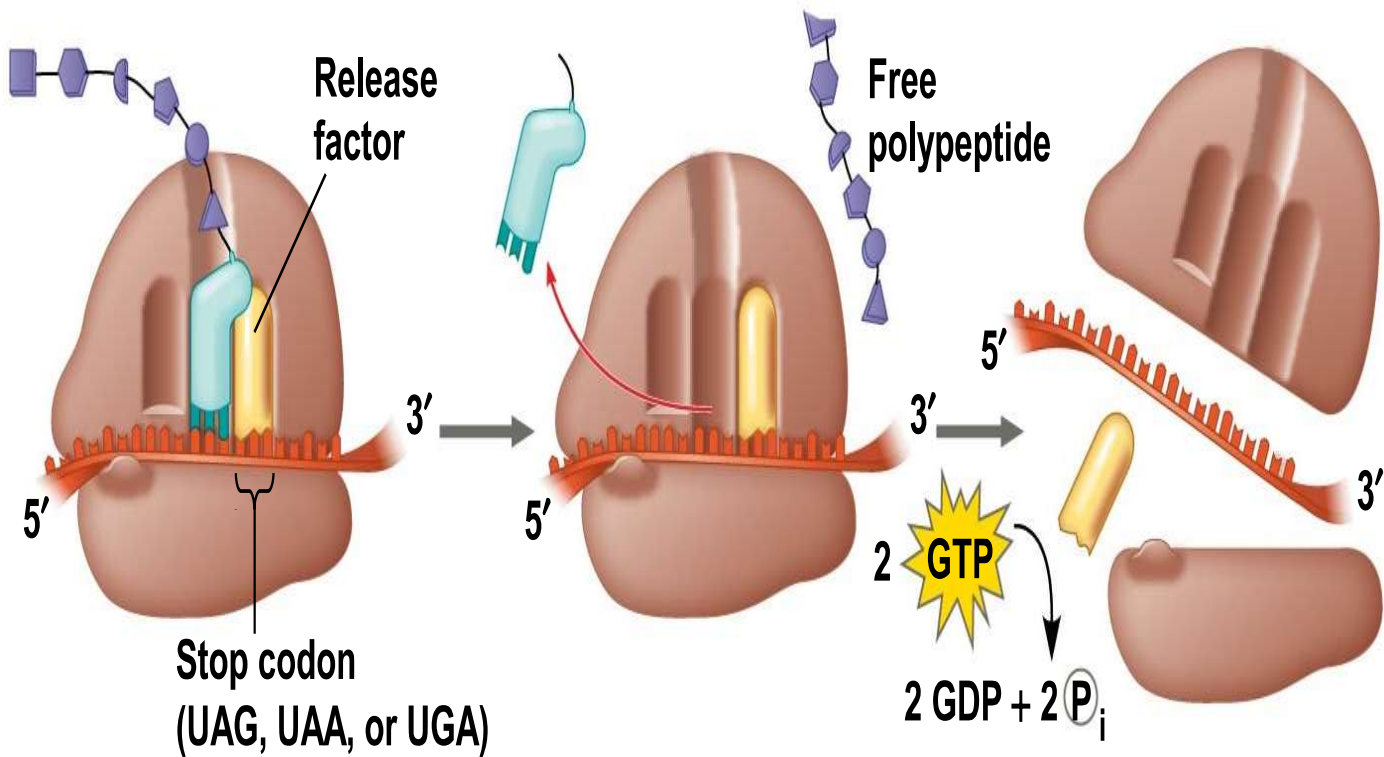




Termination of Translation

- Termination occurs when a stop codon in the mRNA reaches the A site of the ribosome
- The A site accepts a protein called a release factor
- The release factor causes the addition of a water molecule instead of an amino acid
- This reaction releases the polypeptide, and the translation assembly comes apart

Figure 17.20-3



1 Ribosome reaches a stop codon on mRNA.

2 Release factor promotes hydrolysis.

3 Ribosomal subunits and other components dissociate.

Polyribosomes

- A number of ribosomes can translate a single mRNA simultaneously, forming a polyribosome
- Polyribosomes enable a cell to make many copies of a polypeptide very quickly

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