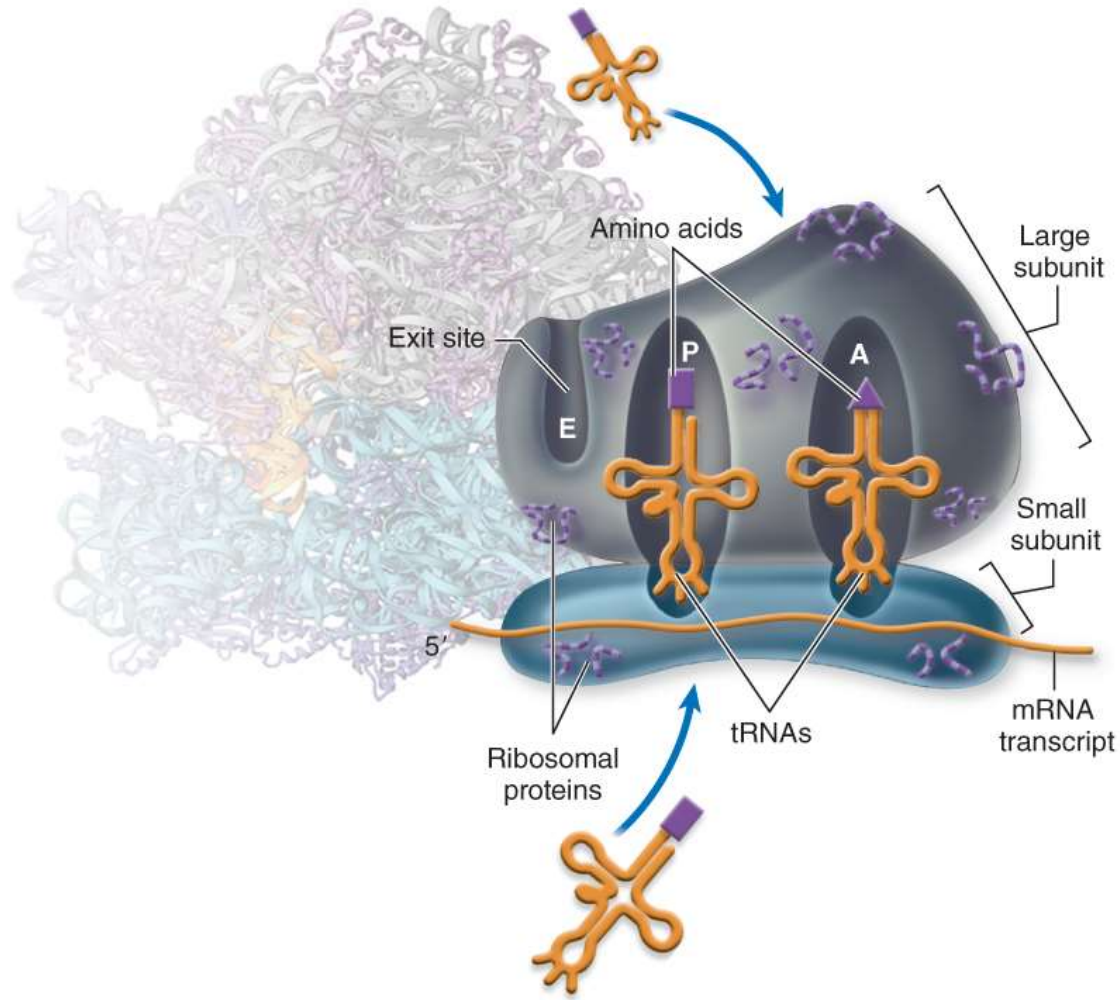


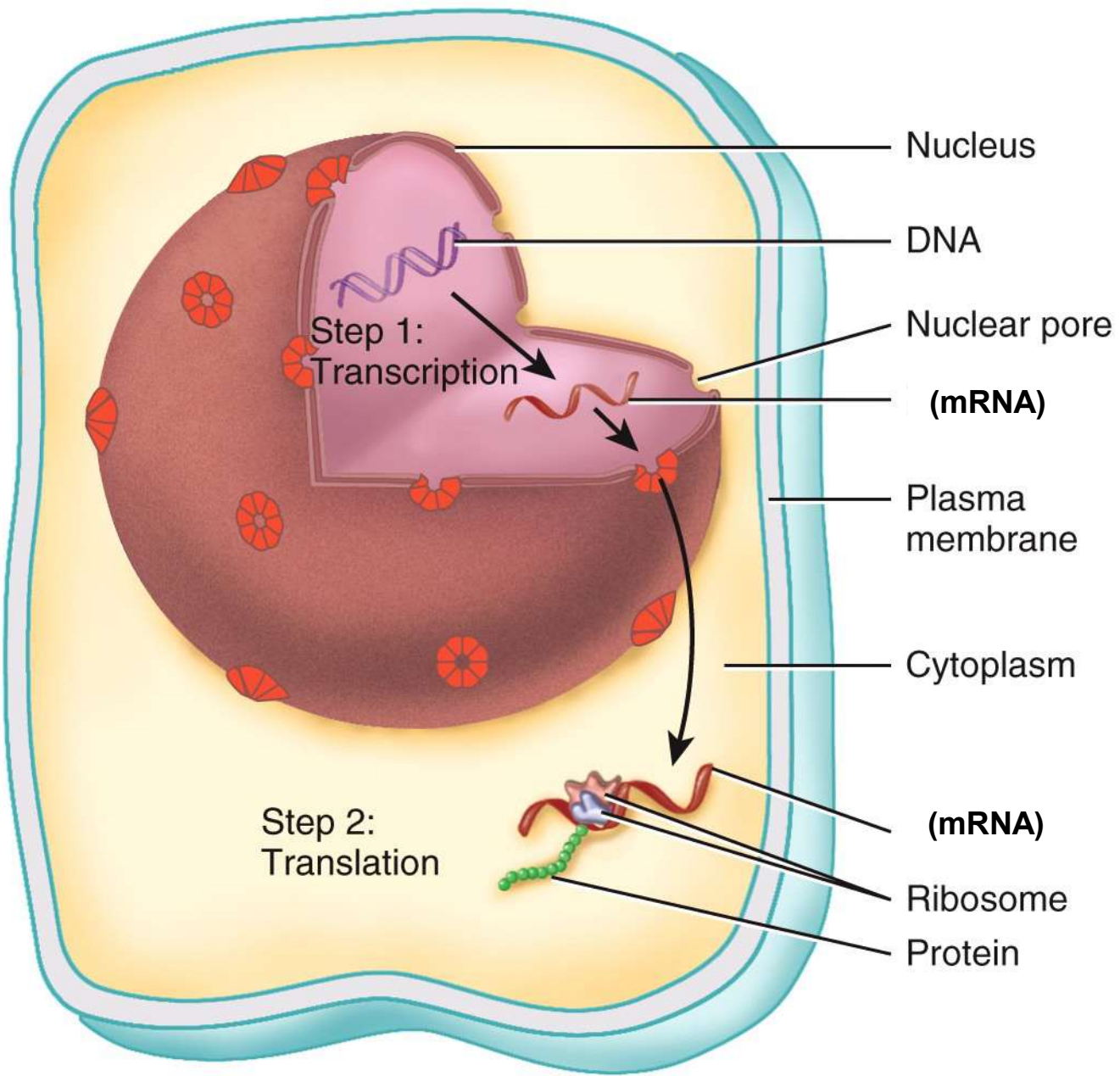
# Introduction to Protein Synthesis



# Summary of Protein Synthesis

---

- How molecular information is transferred in protein synthesis
  - **DNA** → **mRNA** → **protein**
- **Transcription** – the step from **DNA** to **mRNA**
  - occurs in the nucleus where DNA is located
- **Translation** – the step from **mRNA** to **protein**
  - occurs in cytoplasm
  - 15-20% of proteins are synthesized inside the nucleus

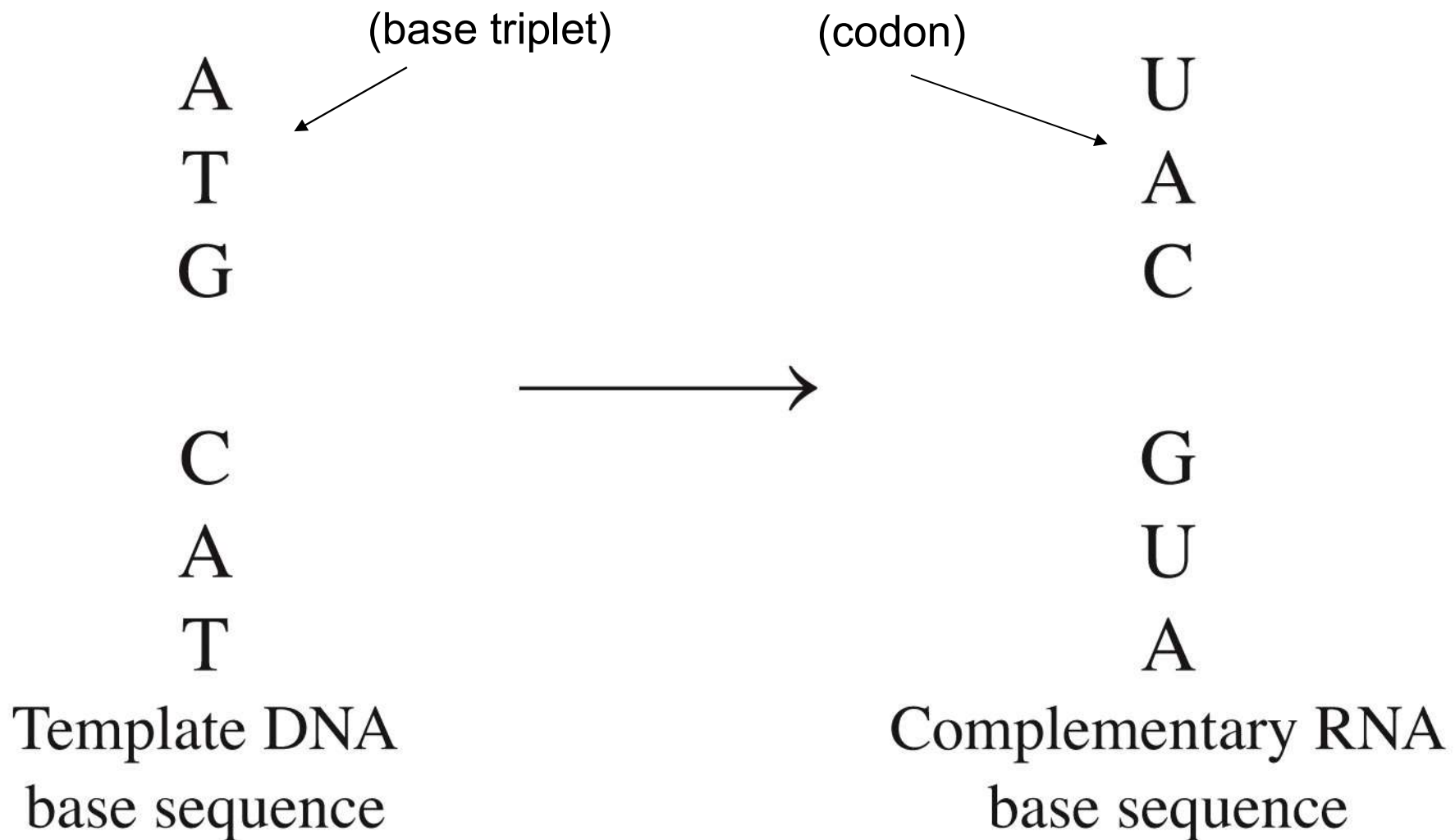


Note: transfer RNA (tRNA) brings amino acids to mRNA–ribosome complex.

# Transcription

---

- DNA too large to leave nucleus and participate directly in protein synthesis which takes place in the cytoplasm
  - necessary to make a small mRNA copy of the DNA gene that can migrate through a nuclear pore into the cytoplasm
- **Transcription** = copying genetic instructions from DNA to mRNA // occurs in nucleoplasm



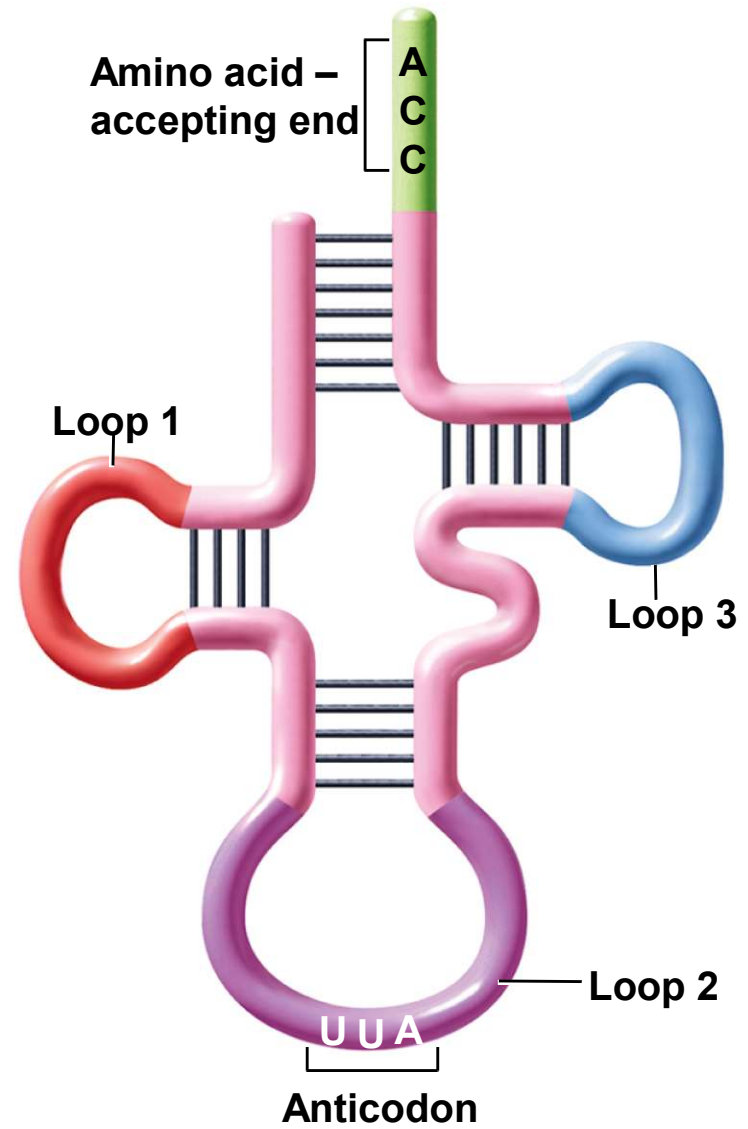
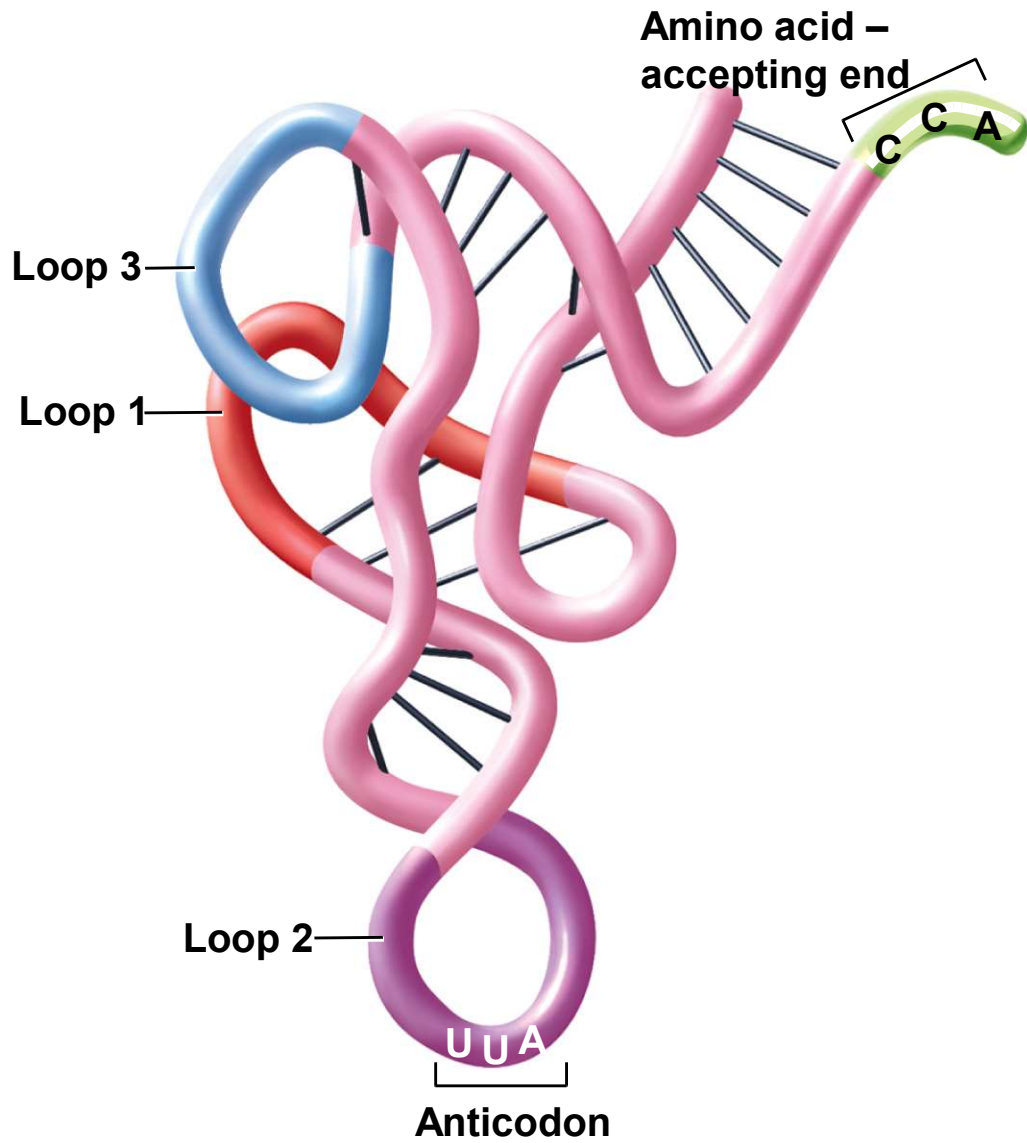
In DNA replication A binds to T but in RNA replication (making mRNA) U substitutes for T therefore the DNA template will bind to "U"

# Translation

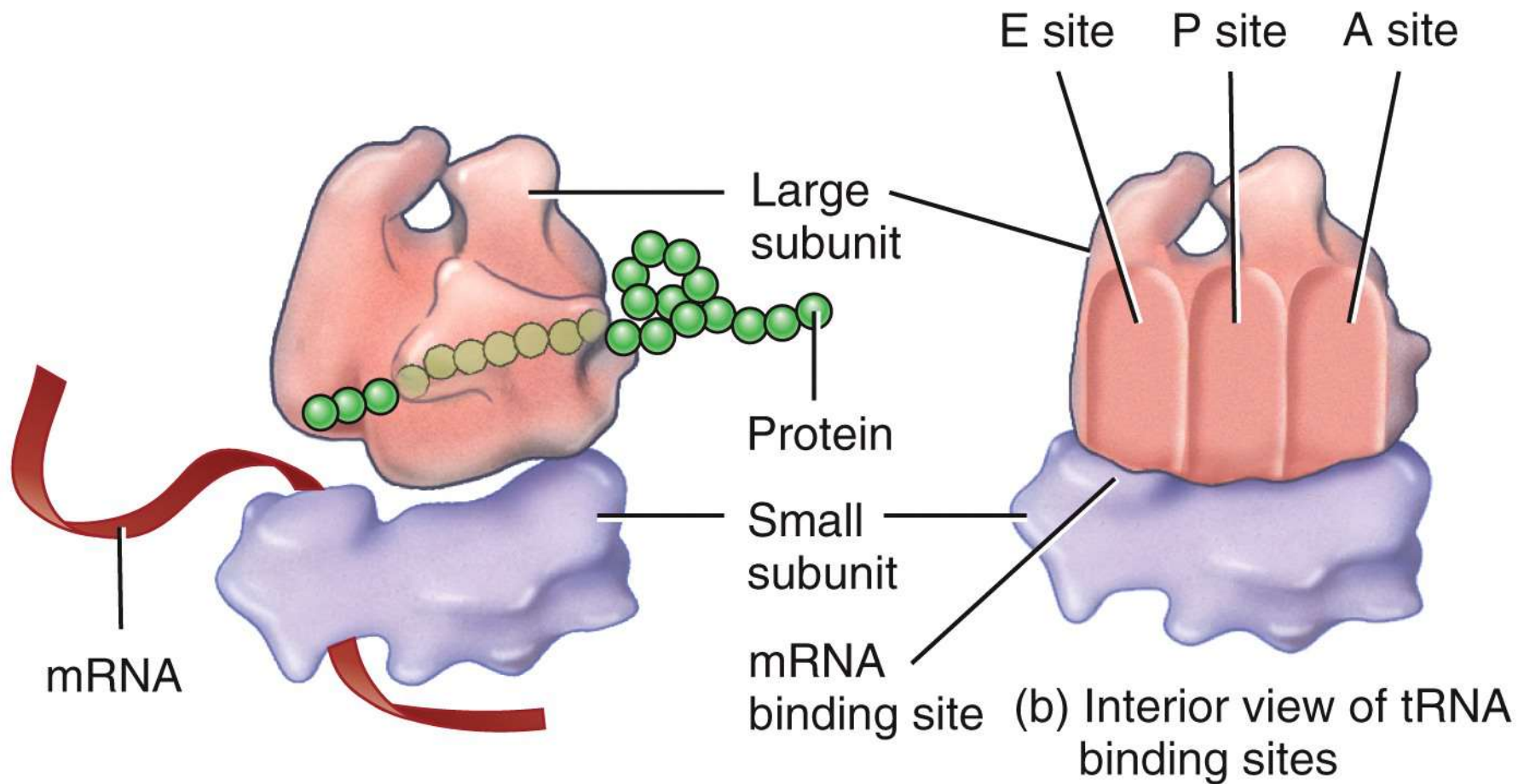
---

- process that converts the **language of nucleotides into the language of amino acids** // occurs in cytoplasm
- **ribosomes (rRNA)** - translate sequence of nucleotides into the sequence of amino acids
  - occur mainly in cytosol // but two different locations for different usage
    - on surface of rough ER and nuclear envelope (proteins for export)
    - free rRNA in cytoplasm (proteins for cell use)
  - consists of two granular subunits, large and small rRNA subunits // each made of several rRNA and enzyme molecules

# Transfer RNA (tRNA)



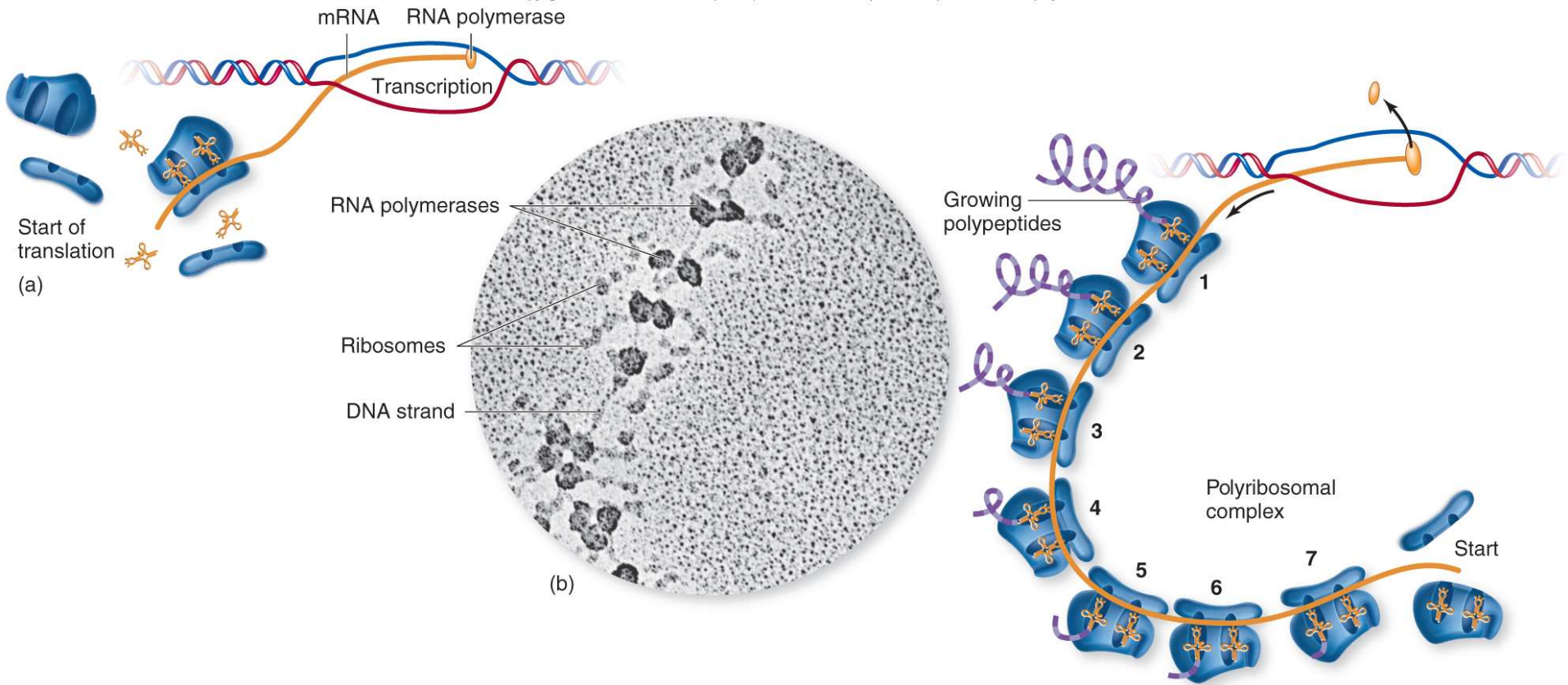




(a) Components of a ribosome and their relationship to mRNA and protein during translation



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



b: Courtesy of Steven McKnight, PhD

# “Steps” in Peptide Formation



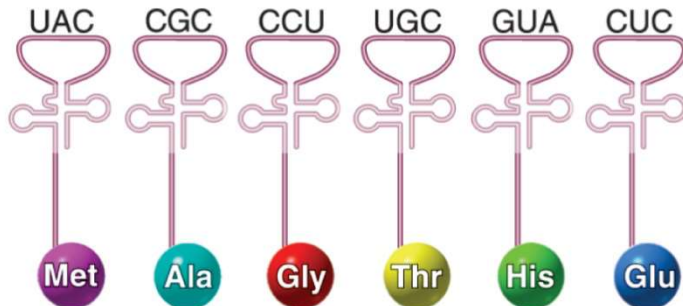
① DNA double helix



② Seven base triplets on the template strand of DNA



③ The corresponding codons of mRNA transcribed from the DNA triplets



④ The anticodons of tRNA that bind to the mRNA codons

⑤ The amino acids carried by those six tRNA molecules



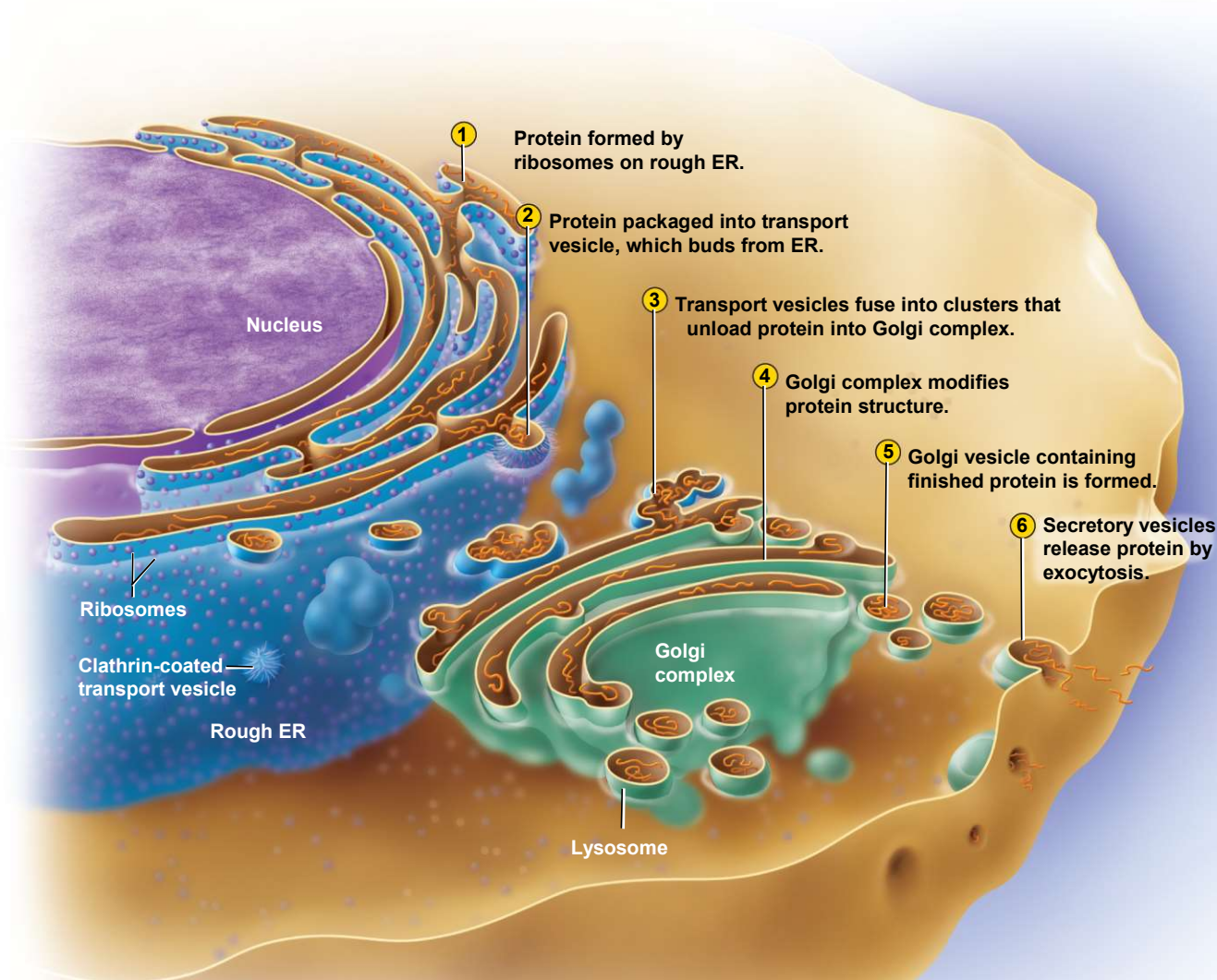
⑥ The amino acids linked into a peptide chain

# Protein Processing and Secretion

---

- **protein synthesis is not finished** when the amino acid sequence (primary structure) has been assembled.
- to be functional it must coil or fold into precise **secondary and tertiary structure**
- **What are chaperone proteins?**
  - older proteins that pick up new proteins and guides the new protein in folding into the proper shapes
  - helps to prevent improper association between different proteins
  - also called **stress proteins** or **heat-shock proteins**
    - chaperones produced in response to heat or stress
    - **help damaged protein fold back into correct functional shapes**

# Protein Packaging and Secretion



Note: Cytoplasmic ribosomes make proteins to be used inside cell //  
endoplasmic ribosomes make proteins to be used in extracellular space