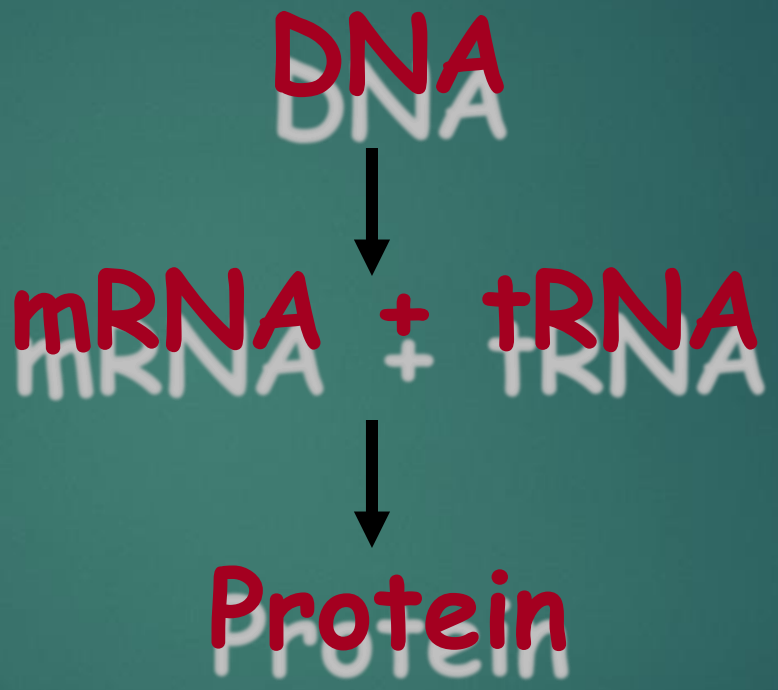
SINTESIS PROTEIN

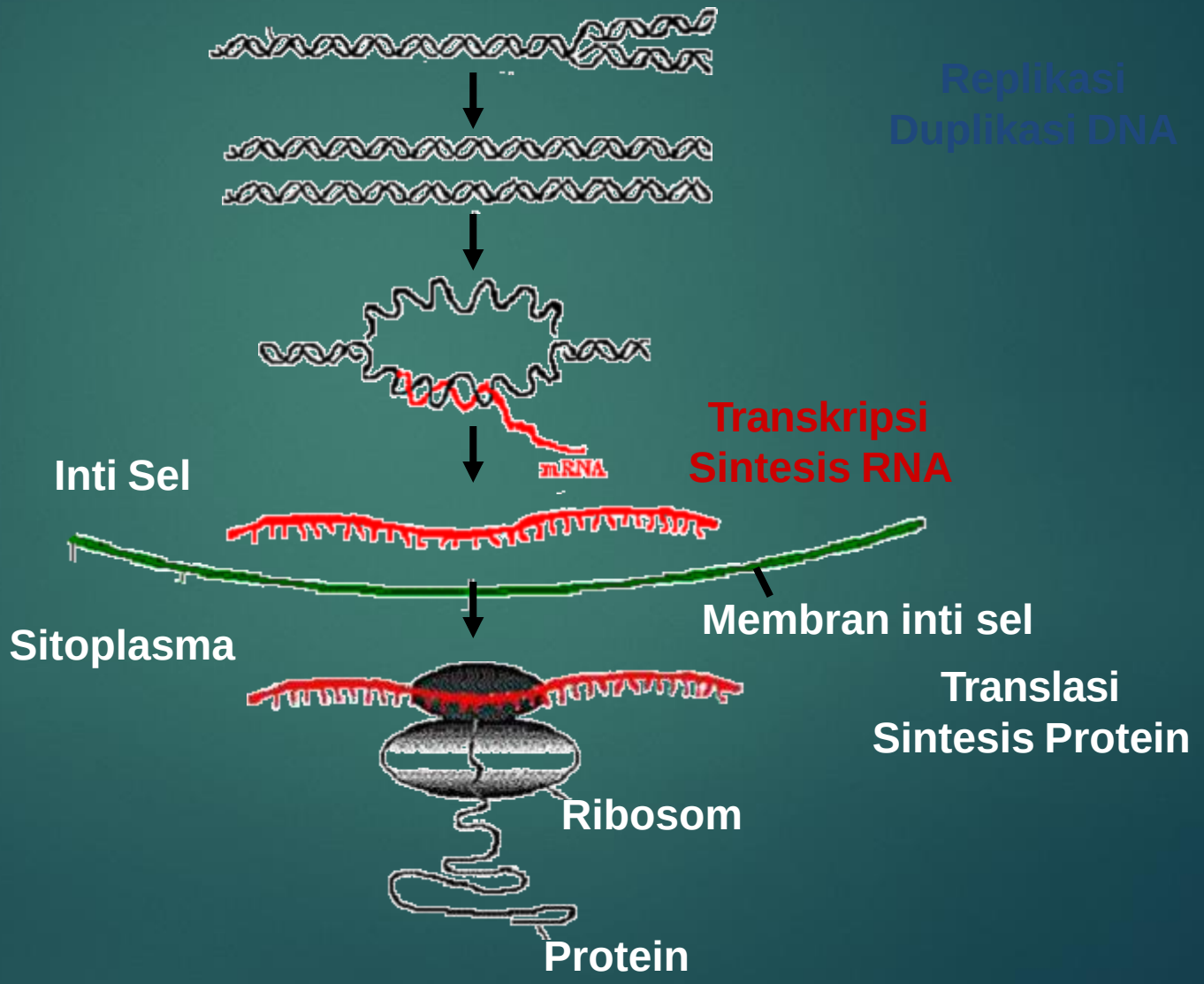
Topik :

- Ribosom, kodon antikodon , tRNA
- Proses : inisiasi, elongasi, dan terminasi
- Pasca translasi : modifikasi asam amino.

Jalur sintesis sebuah Protein

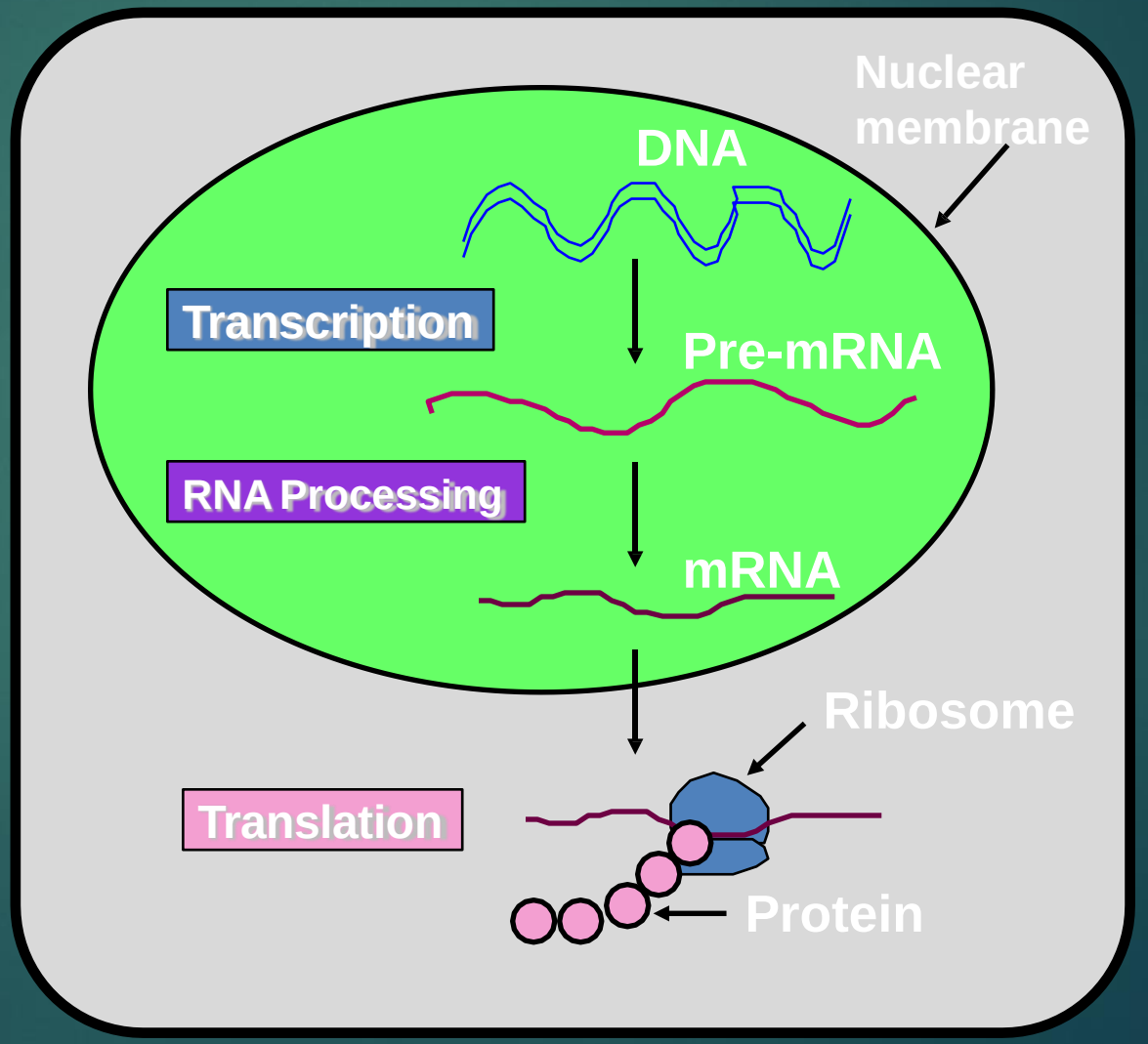


Dogma Sentral Biologi Molekuler



DNA → RNA → Protein

Eukaryotic Cell



Translasi

- Translation adlh proses pembacaan kode-kode pd RNA menjadi asam amino.
- Ribosom membaca mRNA dlm tiap urutan 3 basa (disebut 1 kodon) dan dibaca sbg 1 asam amino yg akan membentuk protein

Komponen untuk translasi

1. Ribosome
2. Template: mRNA
3. tRNAs (transfer RNAs)
4. Accessory proteins
5. Some energy (GTP hydrolysis)

Ribosomes

- RNA-protein complexes (**ribonucleoproteins**)
- Place of translation (protein synthesis)
- Abundant in cells that synthesize large amounts of protein
- Structurally and functionally similar among species (differ between prokaryotes and eukaryotes)

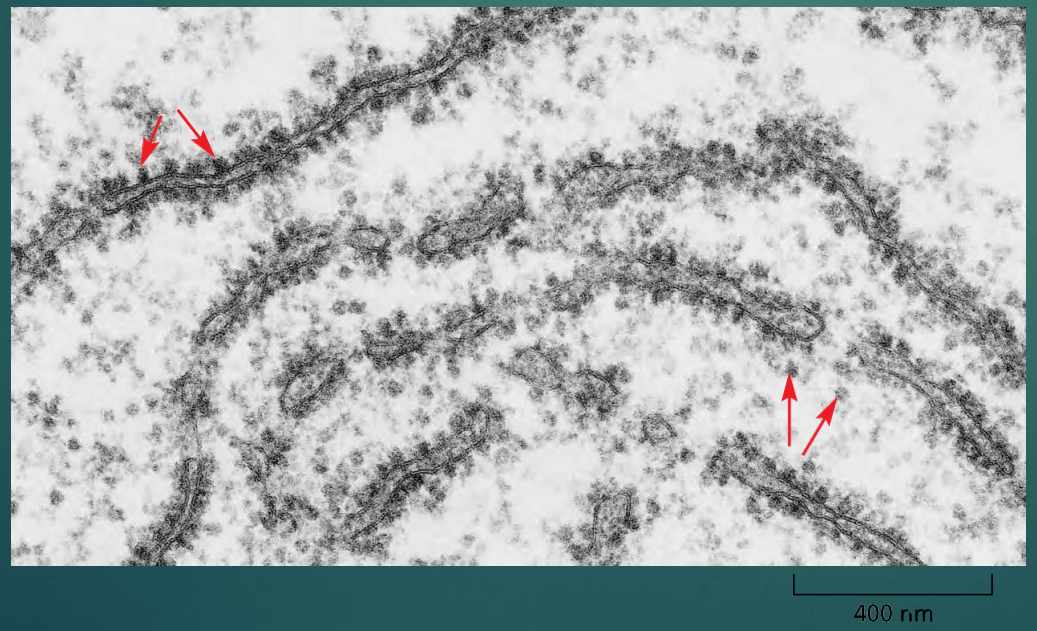
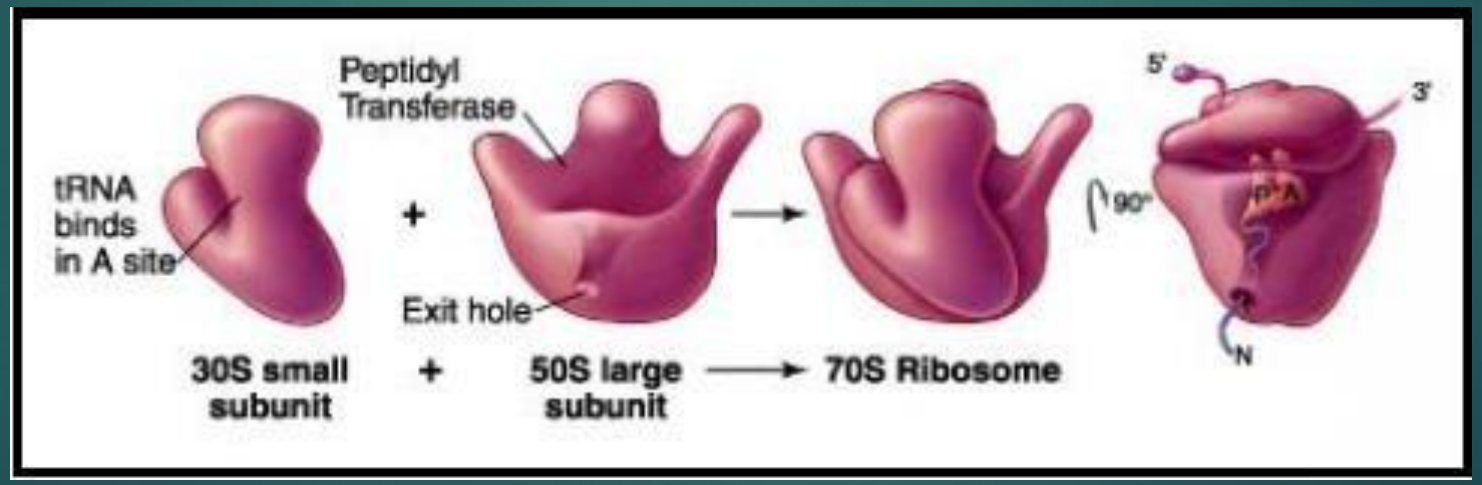


Figure 6–60 Ribosomes in the cytoplasm of a eukaryotic cell. This electron micrograph shows a thin section of a small region of cytoplasm. The ribosomes appear as black dots *(red arrows)*. Some are free in the cytosol; others are attached to membranes of the endoplasmic reticulum. (Courtesy of Daniel S. Friend.)

Ribosomes

- Composed of small and large subunit
- Subunits bind together for translation
- Ribosomes self-assemble without additional factors



Ribosomes

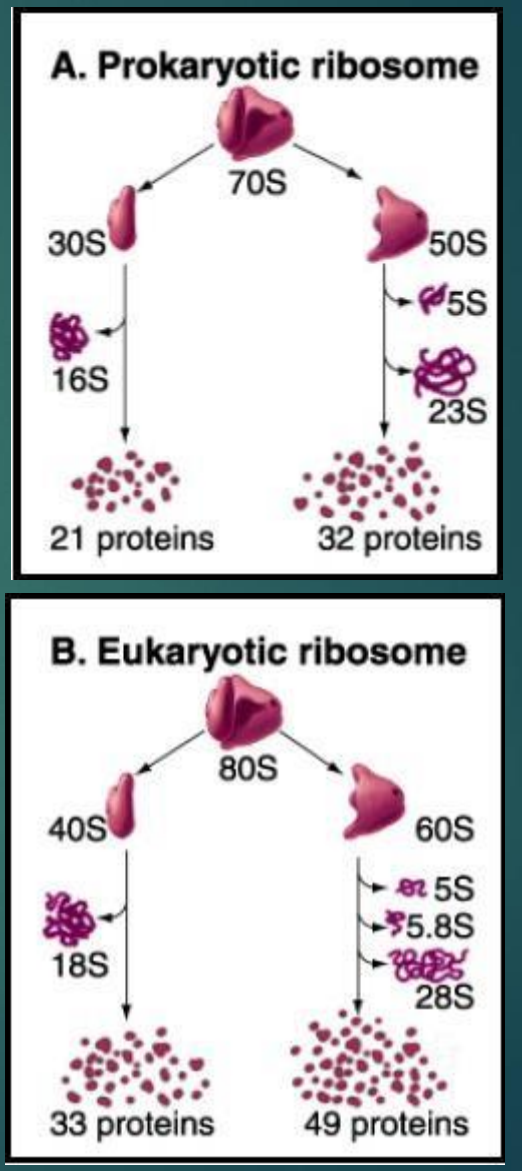
- Contain rRNA molecules and proteins
- In **prokaryotes**

  -Large subunit contains rRNA (5S and 23S) and 32 proteins

  -Small subunit contains 16S rRNA and 21 proteins
- In **eukaryotes**

  -Large subunit contains rRNA (5S, 5.8S and 28S) and 49 proteins

  -Small subunit contains 18S rRNA and 33 proteins



Ribosomes

- Cytosolic (free)
- Bound to ER
- Also located in mitochondria and chloroplasts of eukaryotic cells
- **Free ribosomes**

  - Found in the cytosol

  -May exist as a single ribosome or in groups known as polysomes

  - Occur in greater number than bound ribosomes in cells that retain most of their manufactured protein in the cytosol
- **Bound ribosomes**

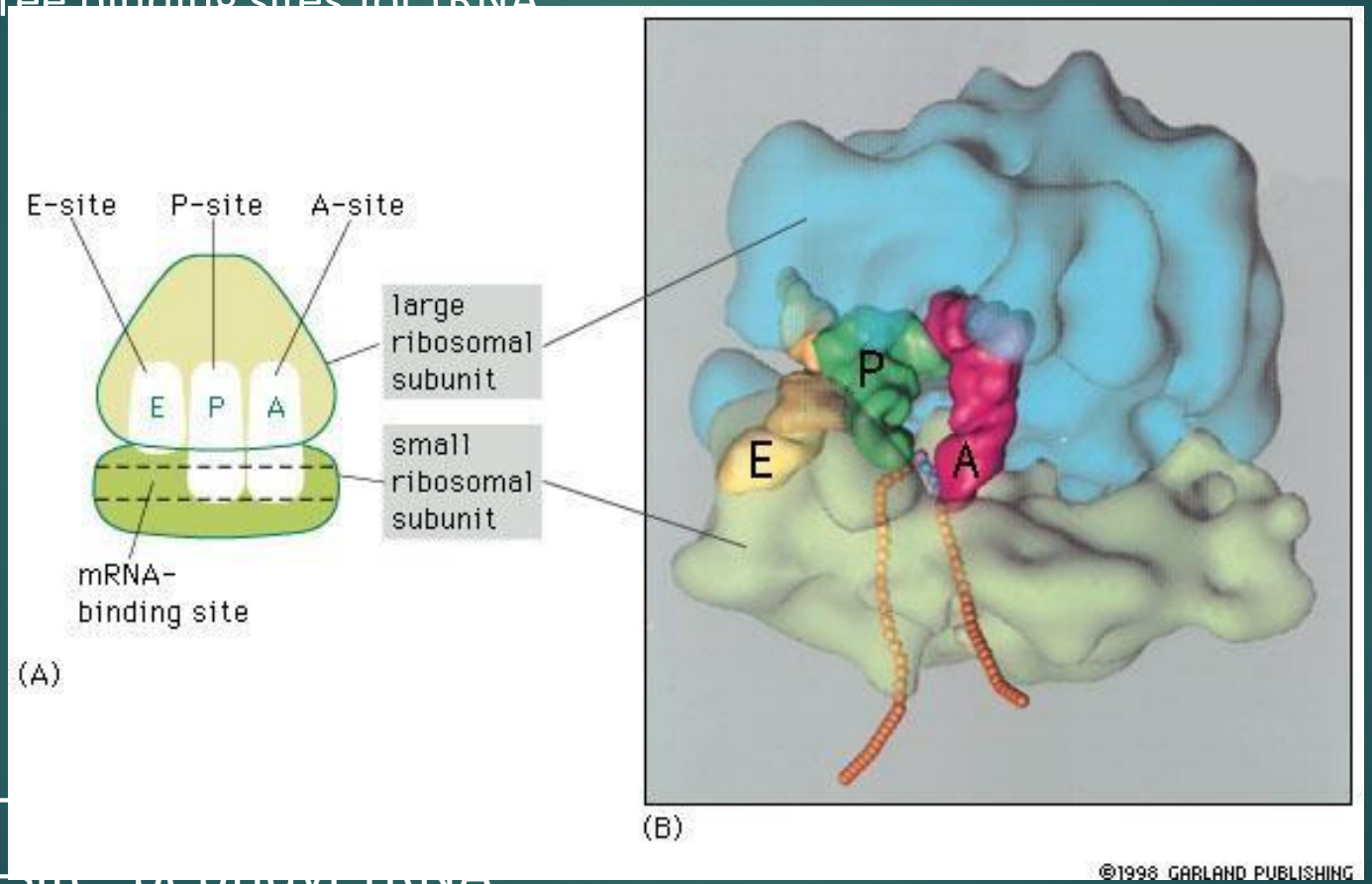
  - Bound to the exterior of the rough endoplasmic reticulum

  - Occur in greater number than free ribosomes in cells that secrete their manufactured proteins (e.g., pancreatic cells)

RNA-binding sites in the ribosome

Each ribosome has 4 binding sites for RNA molecules:

- a binding site for mRNA
- three binding sites for tRNA

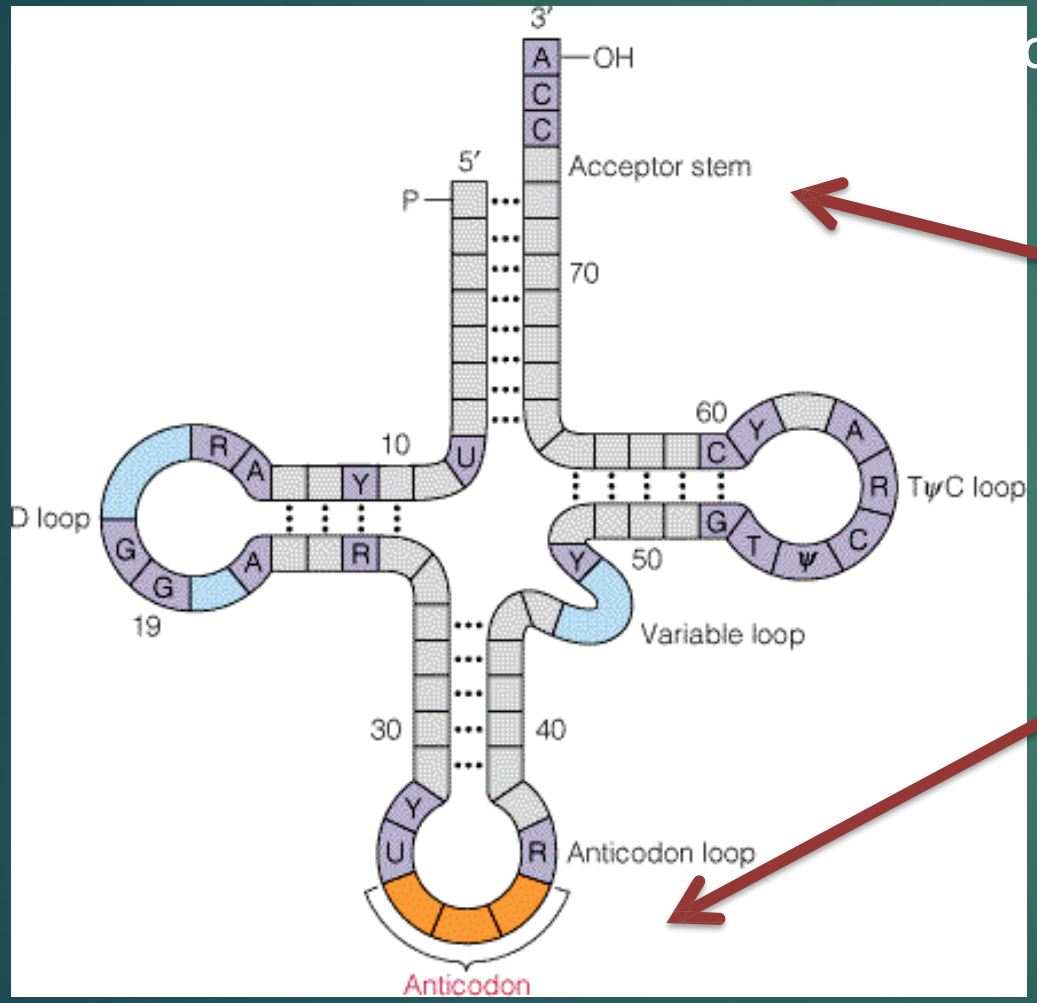


- A-
- P-site: peptidyl-tRNA
- E-site: exit

Transfer RNAs (tRNAs)

- **Adaptor molecules** that match amino acids to codons in mRNA
- Any cell contains different types of tRNA molecules sufficient to incorporate all 20 amino acids into protein
- Some tRNAs can recognise more than one codon
- About 80 nucleotides in length

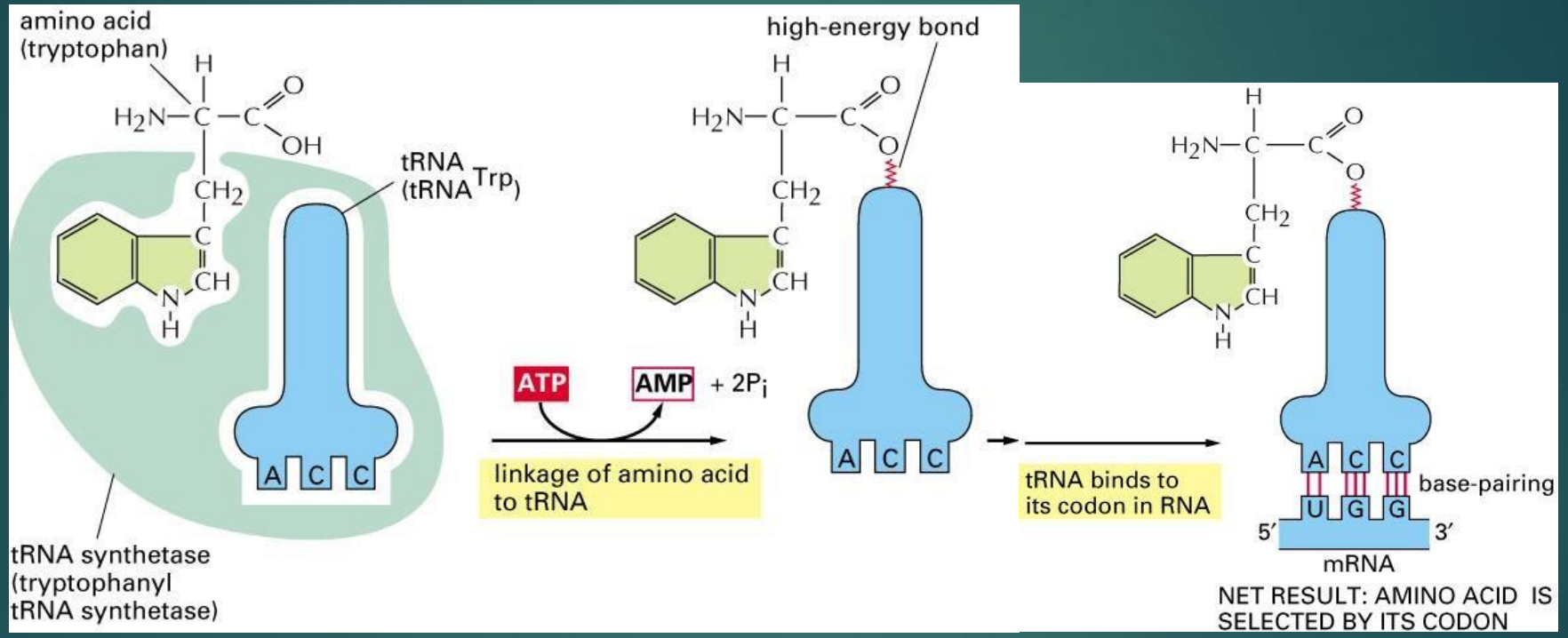
Structures of tRNAs



All tRNAs share a general common structure that includes:

- an **acceptor stem** (to which the amino acid is attached)
- an **anticodon triplet loop** (pairs with mRNA codons)

The genetic code is translated by means of two adaptors that act one after another



Dibutuhkan energi berupa GTP dalam proses translasi

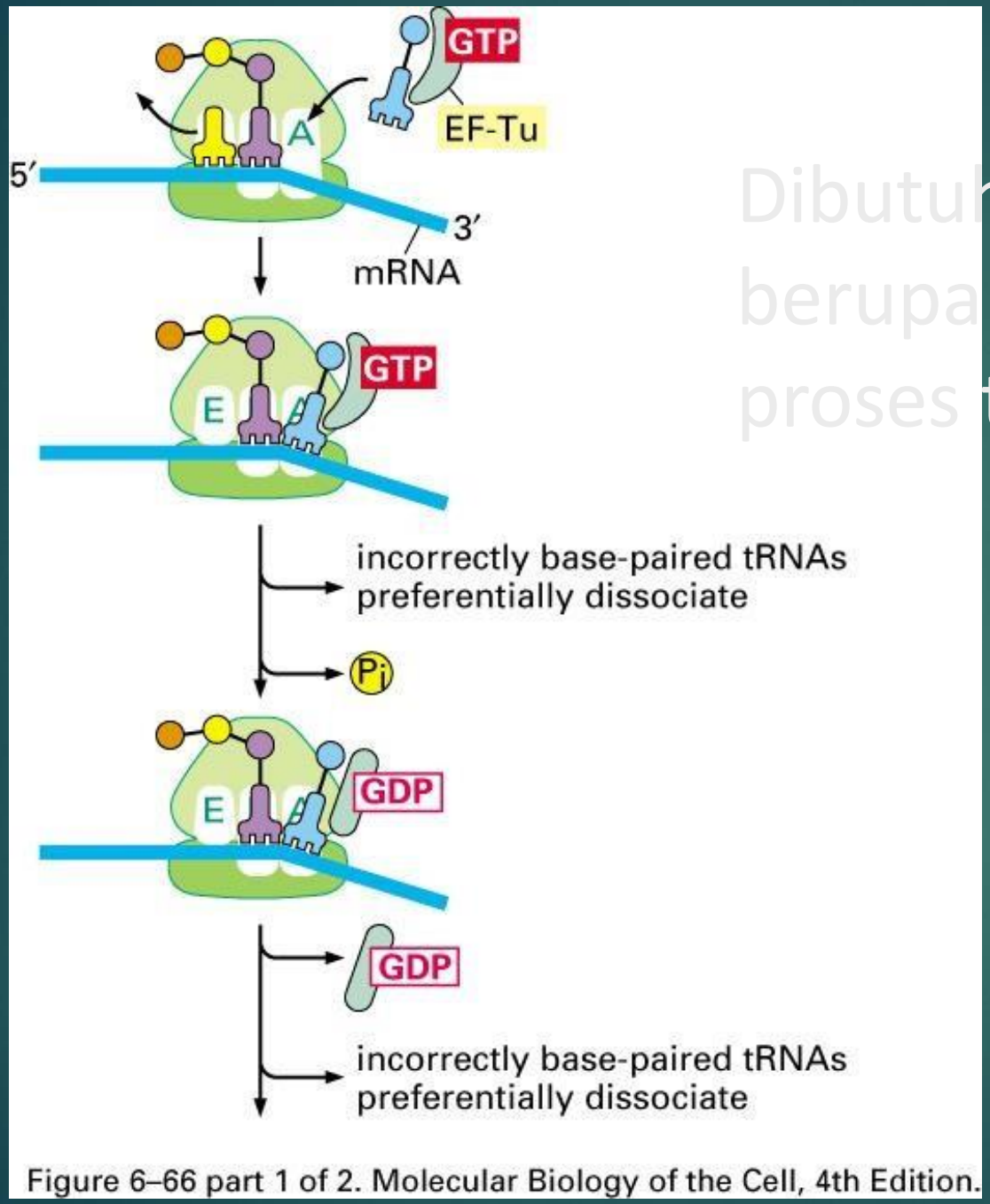
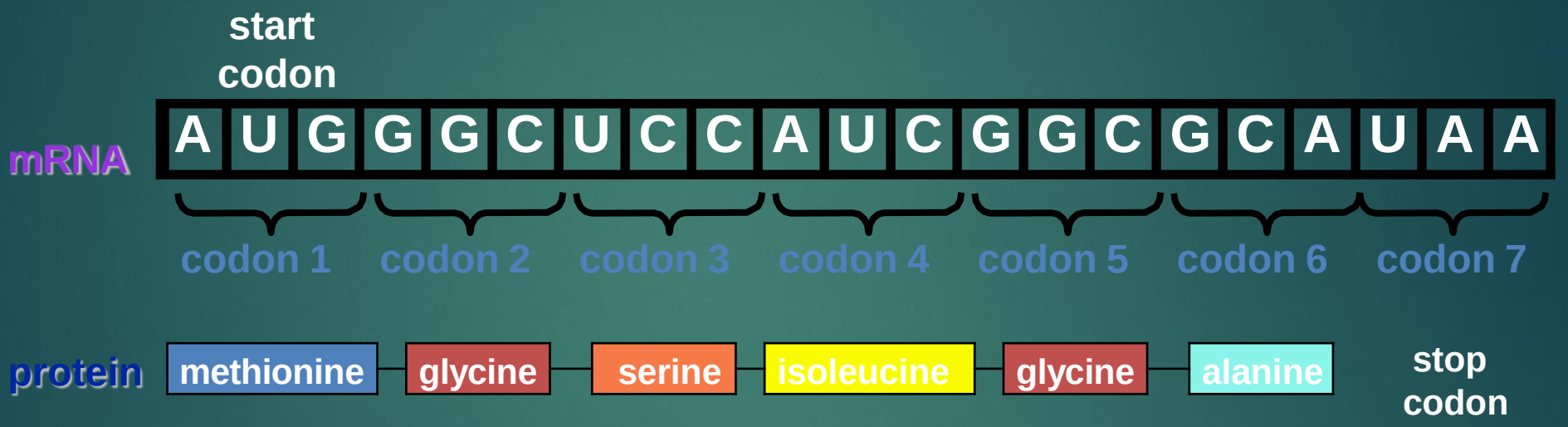
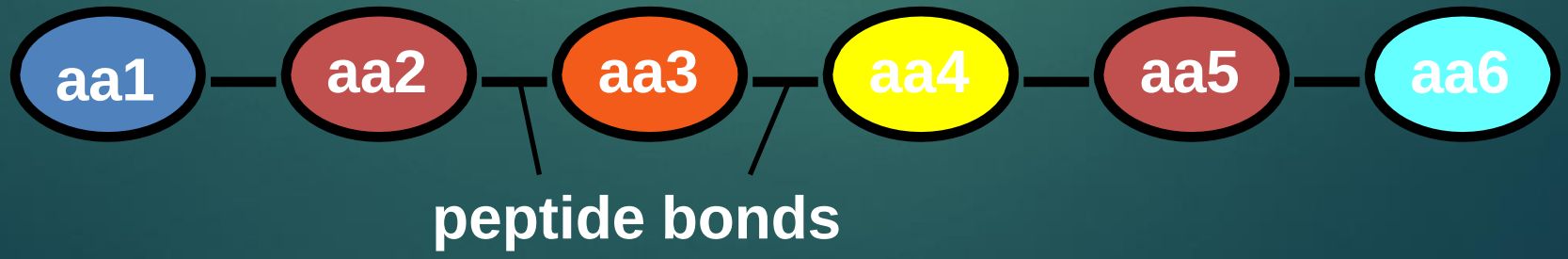


Figure 6–66 part 1 of 2. Molecular Biology of the Cell, 4th Edition.

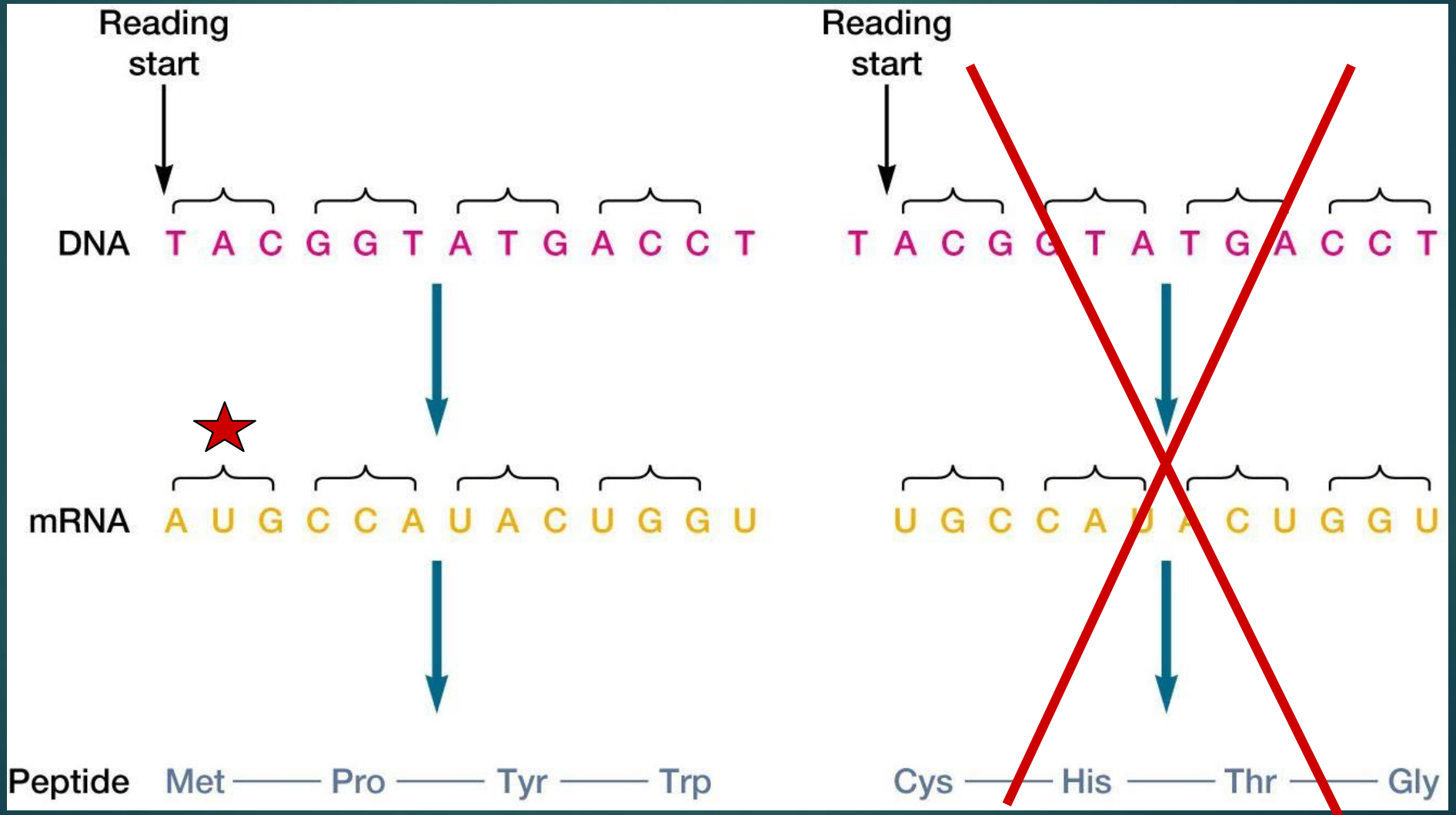
Messenger RNA (mRNA)

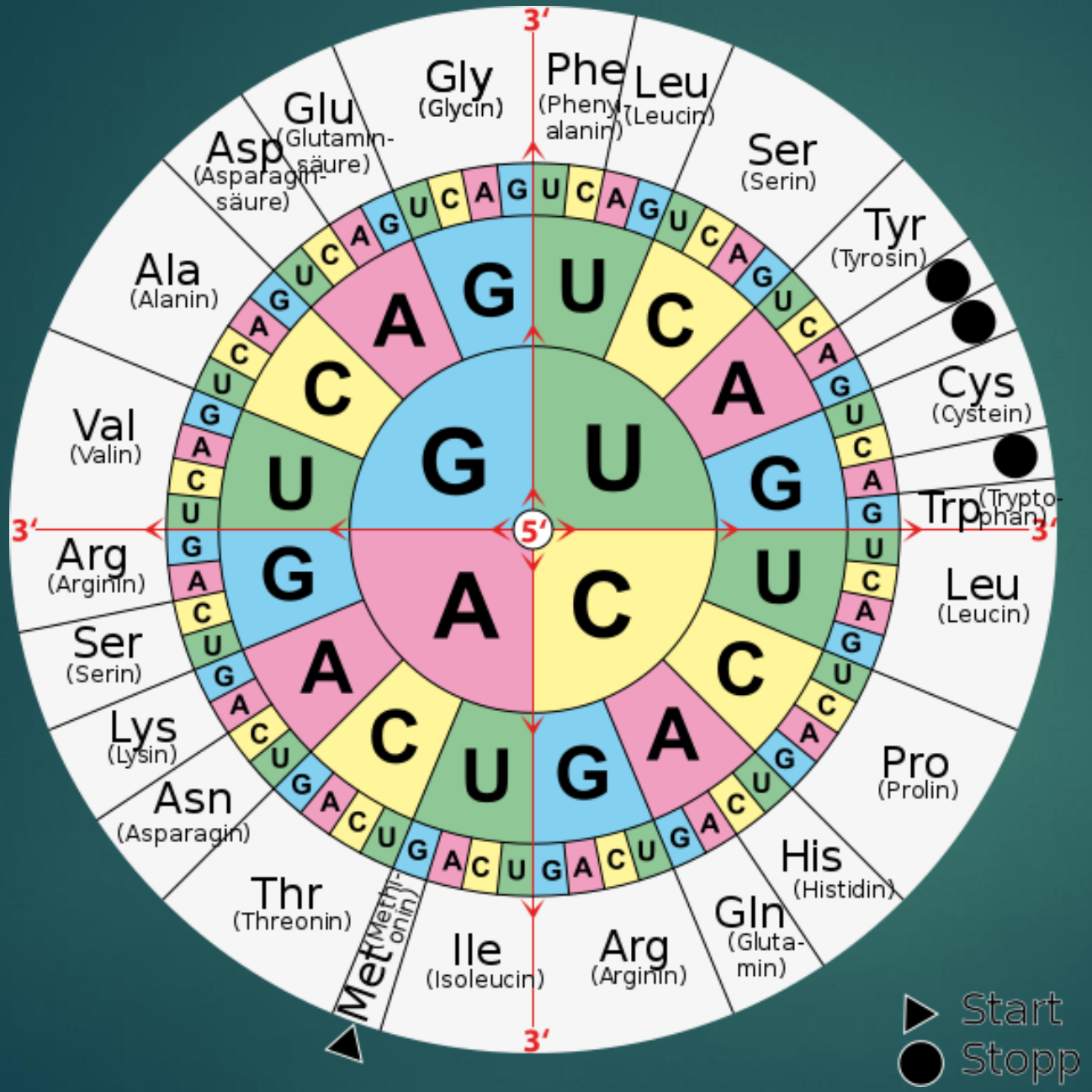


Primary structure of a protein



Initiation Codon establishes the proper “reading-frame”!



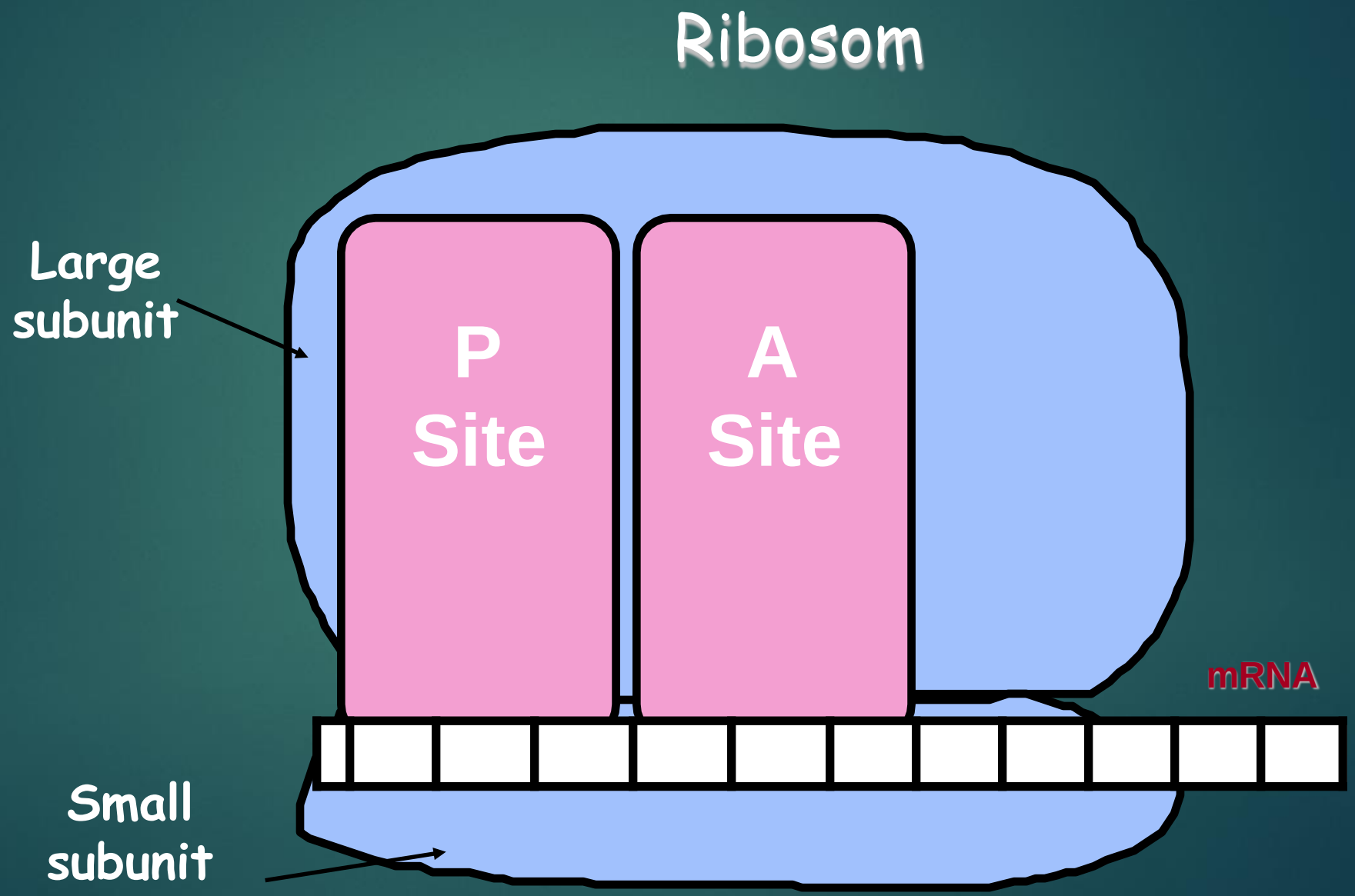

3′
5′
Gly (Glycin)
Phe (Phenylalanin)
Leu (Leucin)
Ser (Serin)
Tyr (Tyrosin)
Cys (Cystein)
Trp (Tryptophan)
Leu (Leucin)
Pro (Prolin)
His (Histidin)
Gln (Glutamin)
Arg (Arginin)
Ile (Isoleucin)
Met (Methionin)
Thr (Threonin)
Asn (Asparagin)
Lys (Lysin)
Ser (Serin)
Arg (Arginin)
Val (Valin)
Ala (Alanin)
Asp (Asparaginsäure)
Glu (Glutaminsäure)
Start
Stopp

Proses translasi

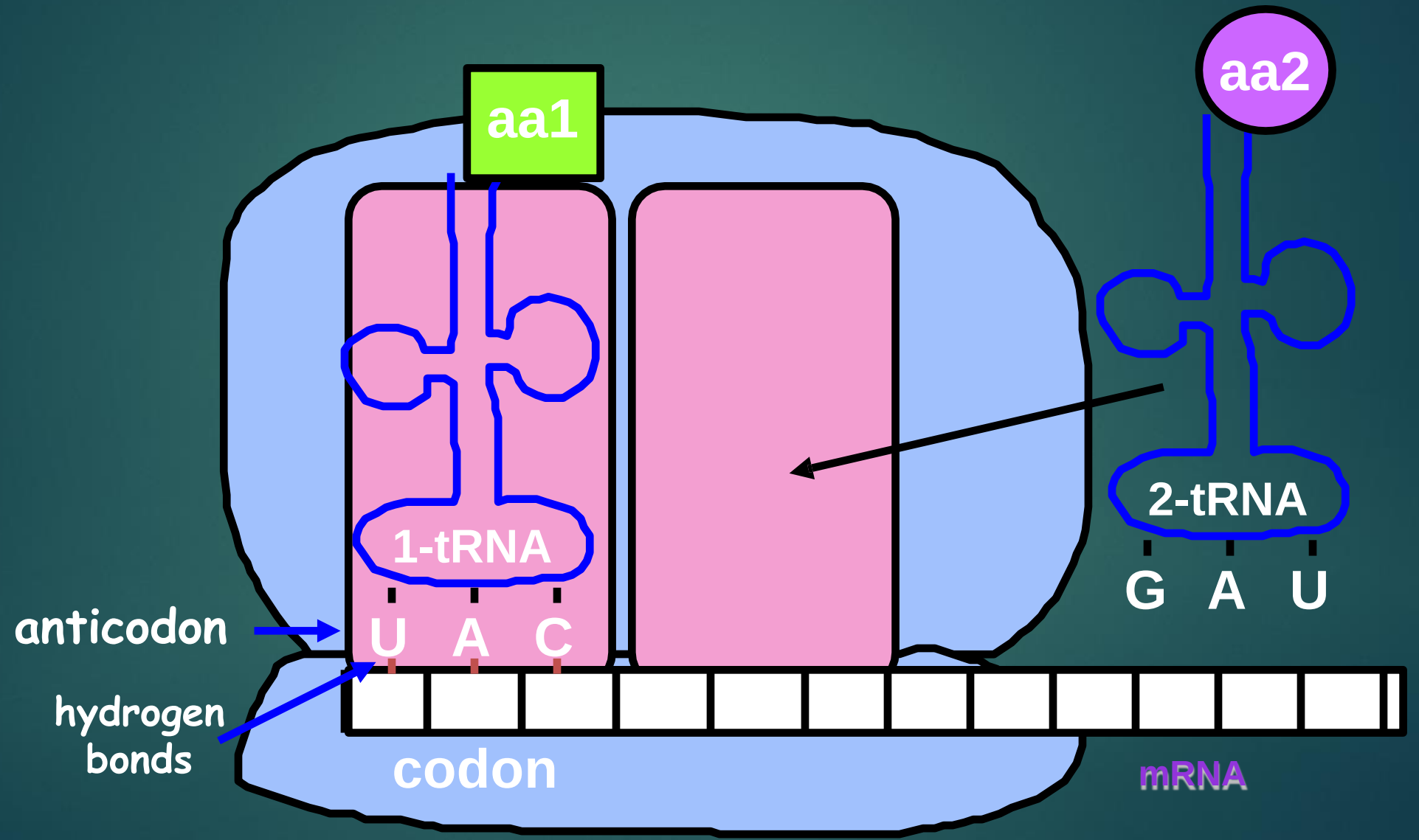
https://www.youtube.com/watch?v=Ikq9AcBcohA

https://www.youtube.com/watch?v=5bLEDd-PSTQ

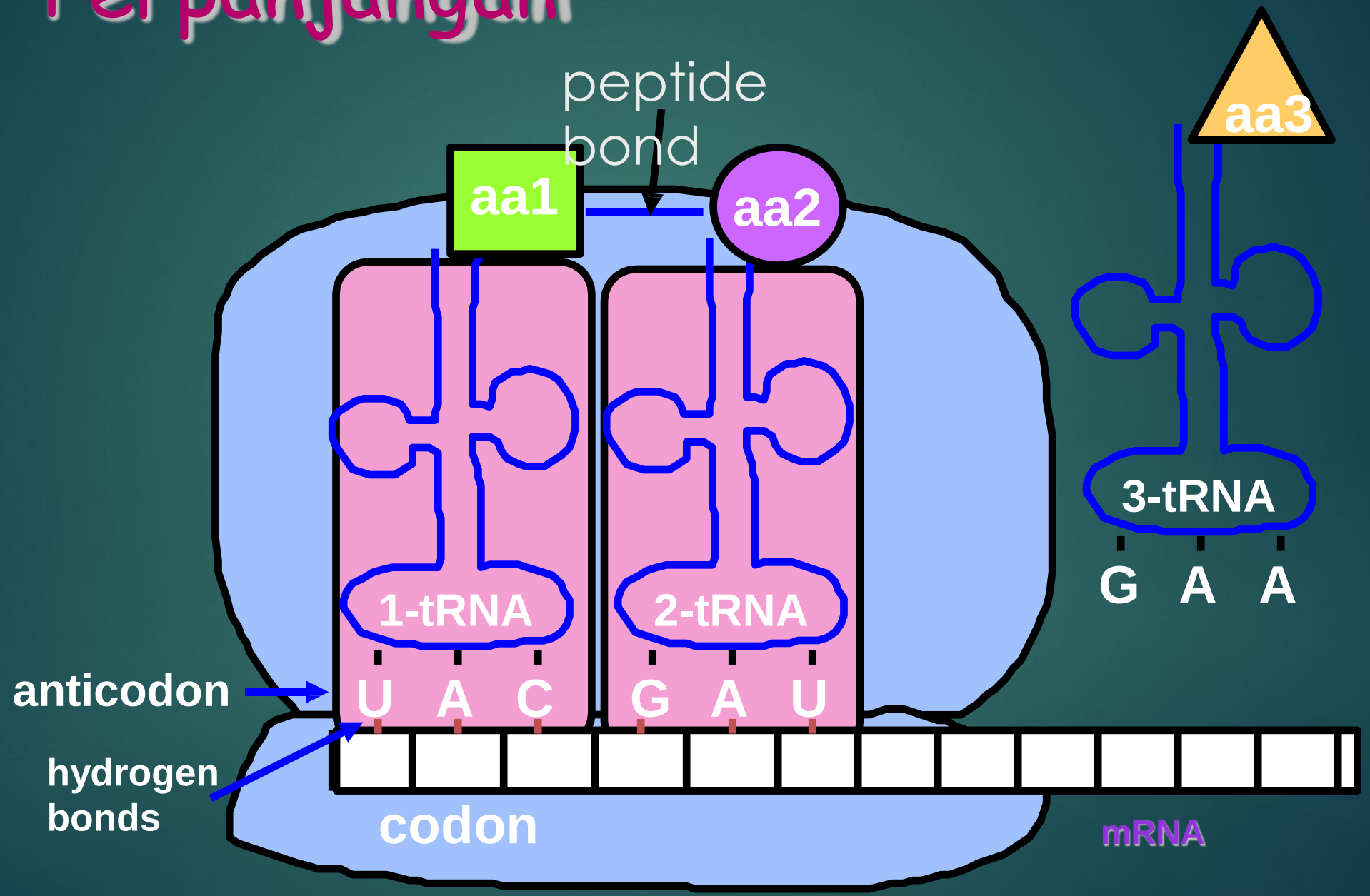
Step 1 - Inisiasi

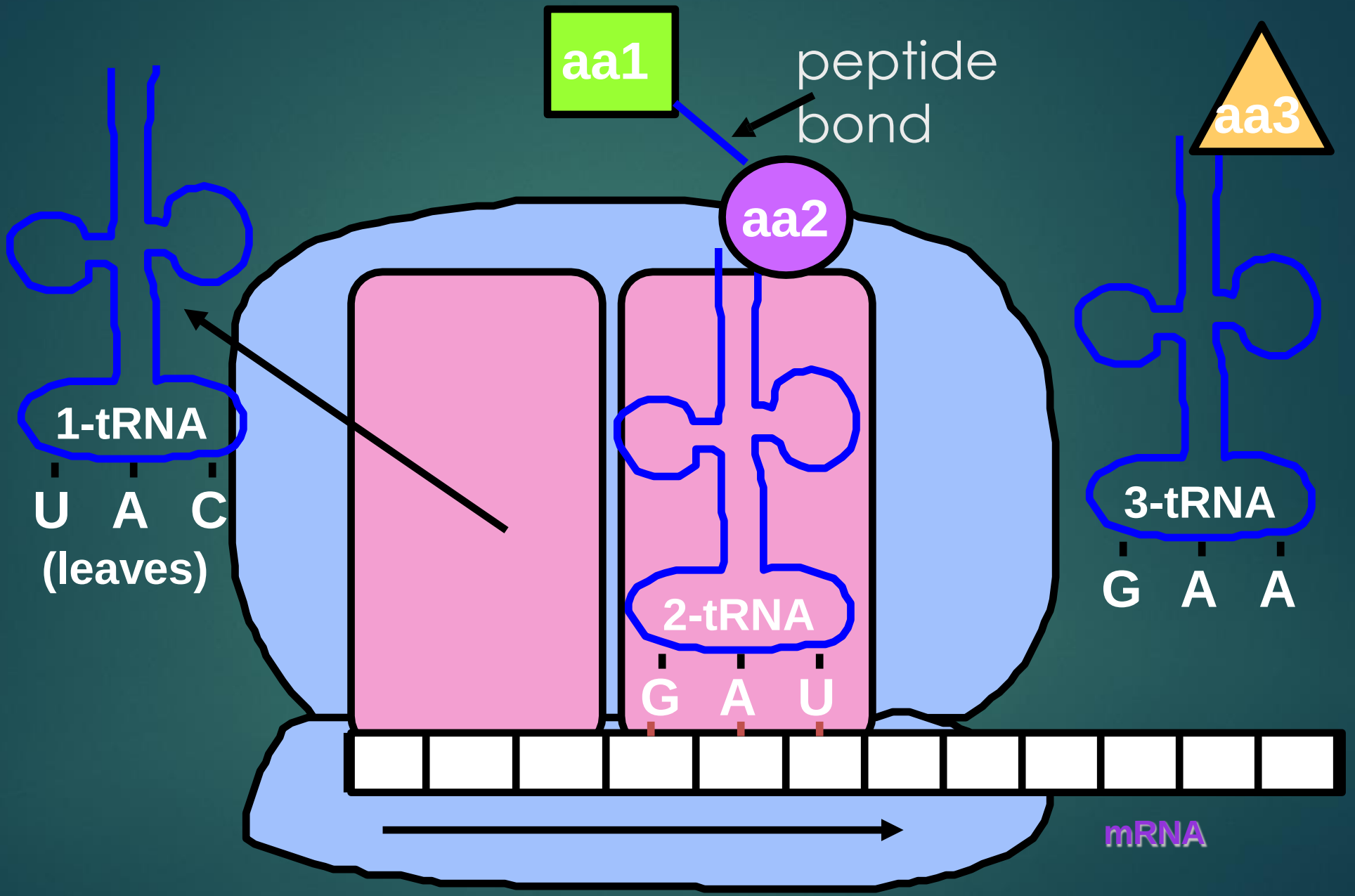


Initiation

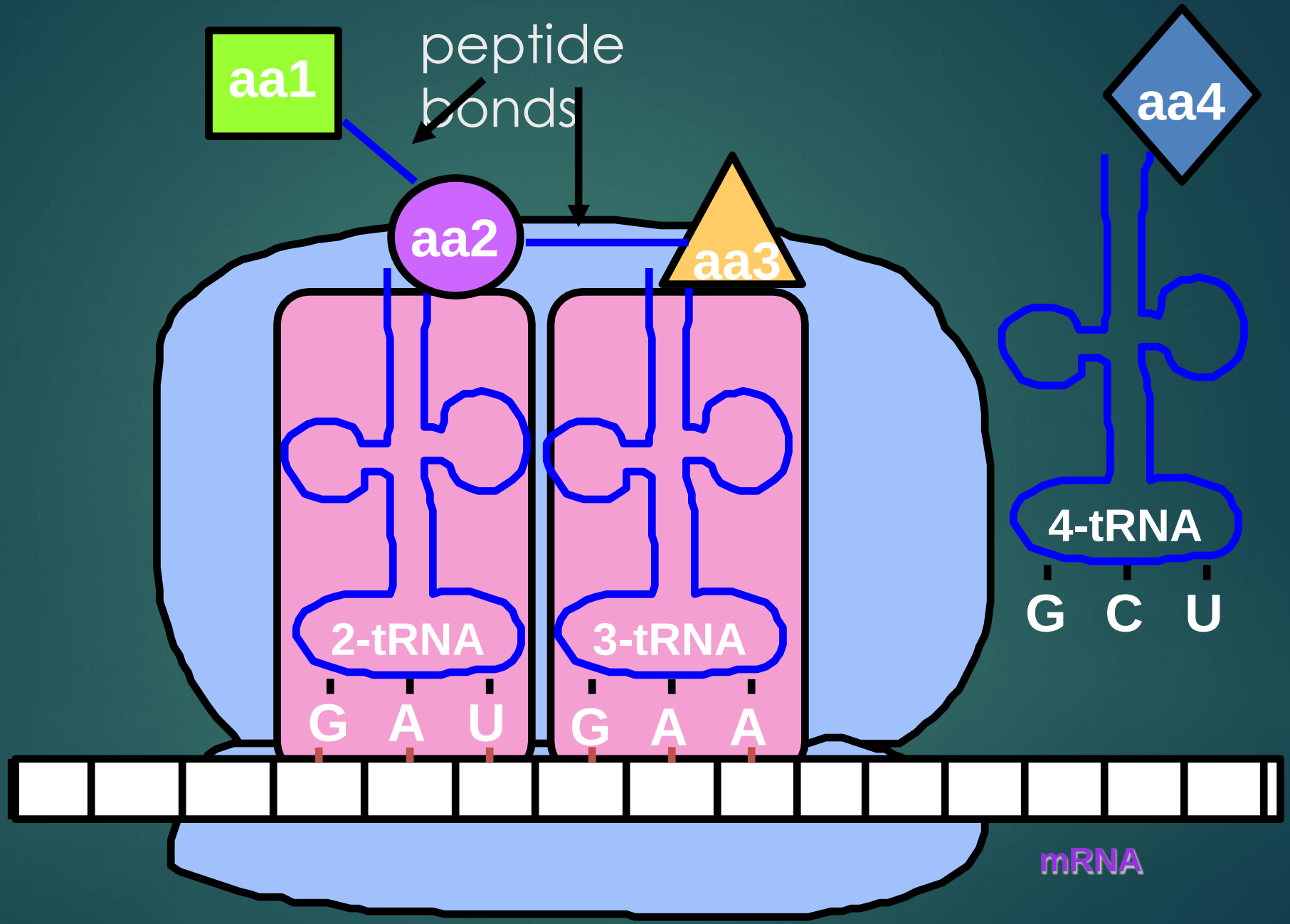

aa2
aa1
2-tRNA
1-tRNA
G A U
anticodon
U A C
hydrogen bonds
codon
mRNA

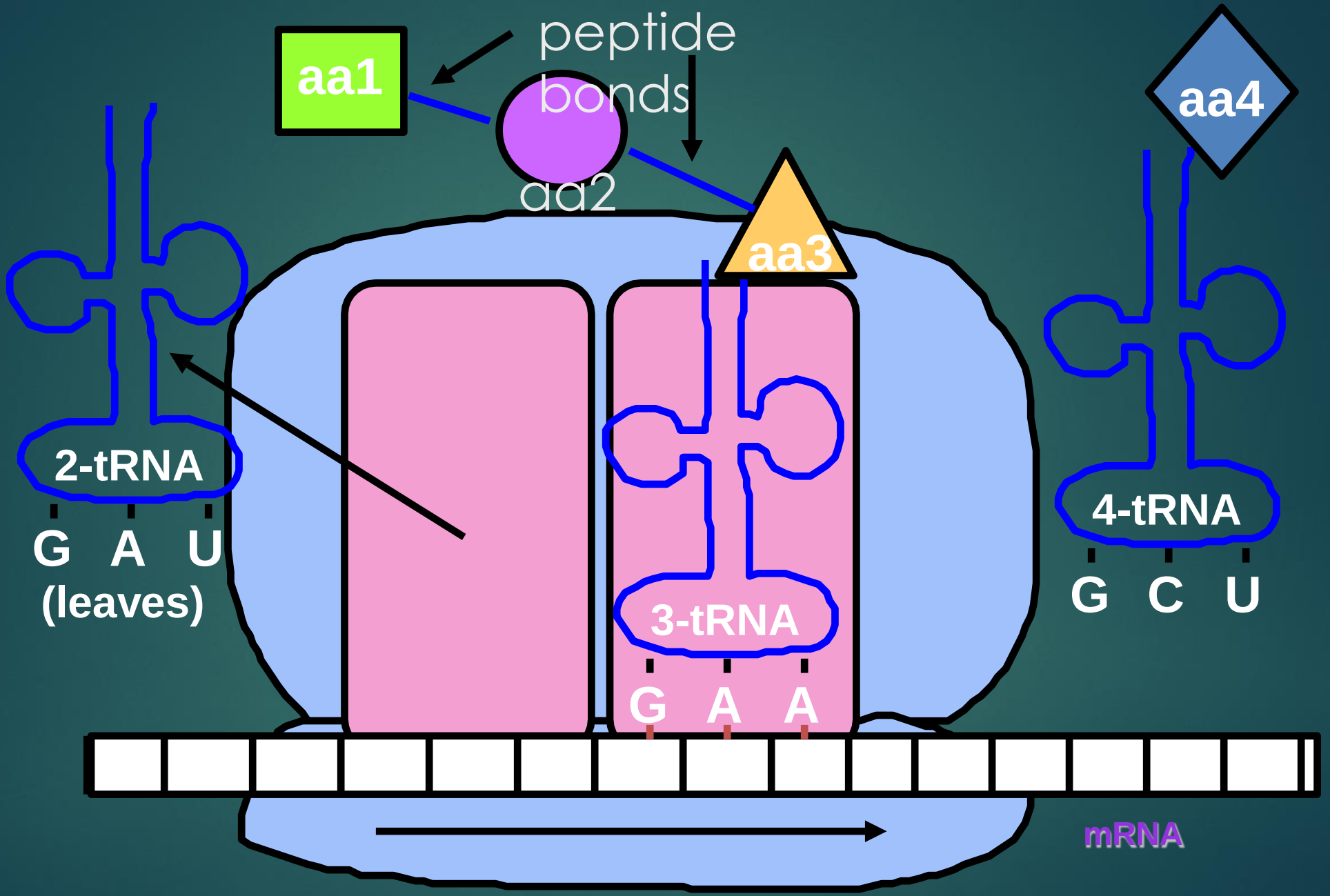
Perpanjangan



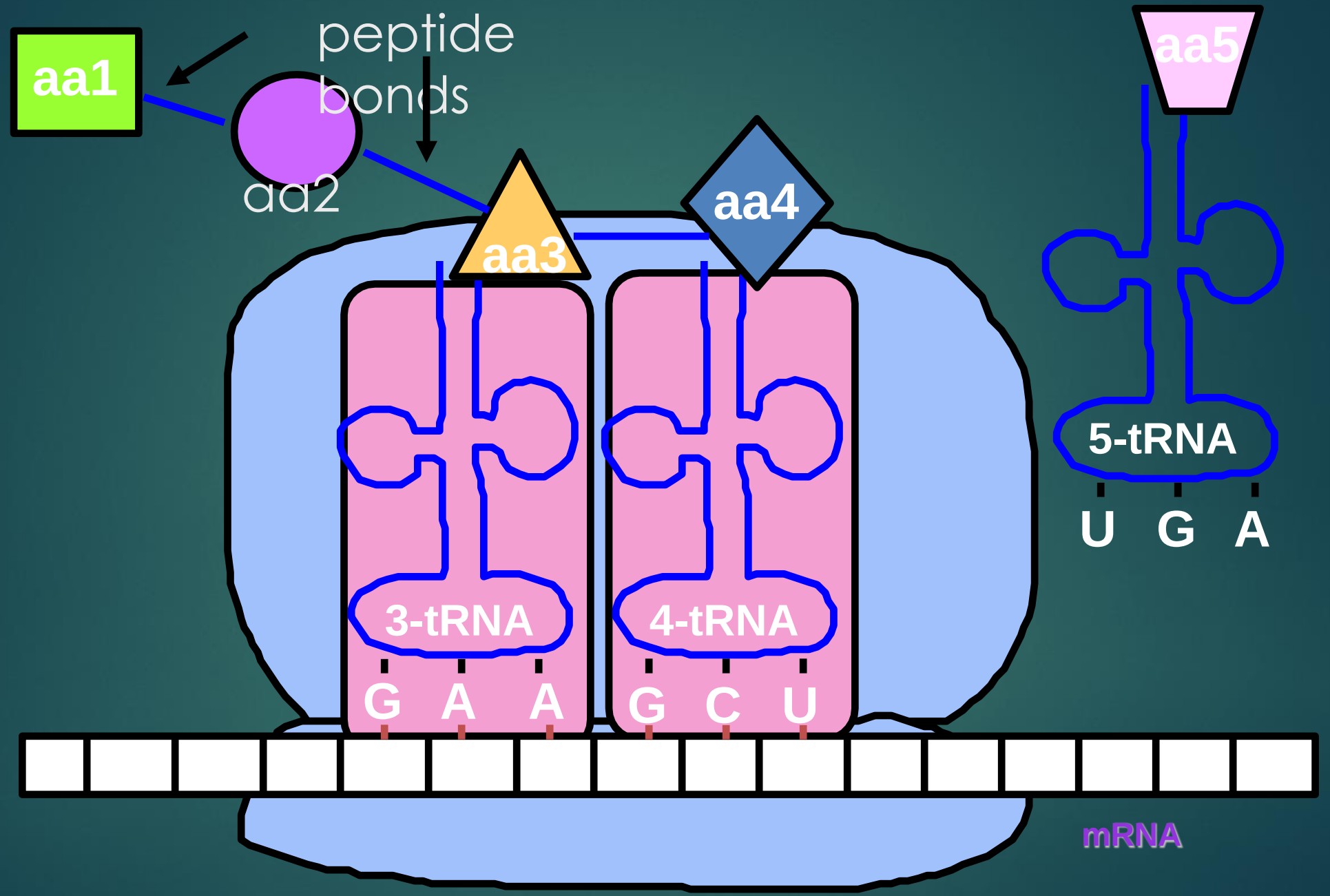


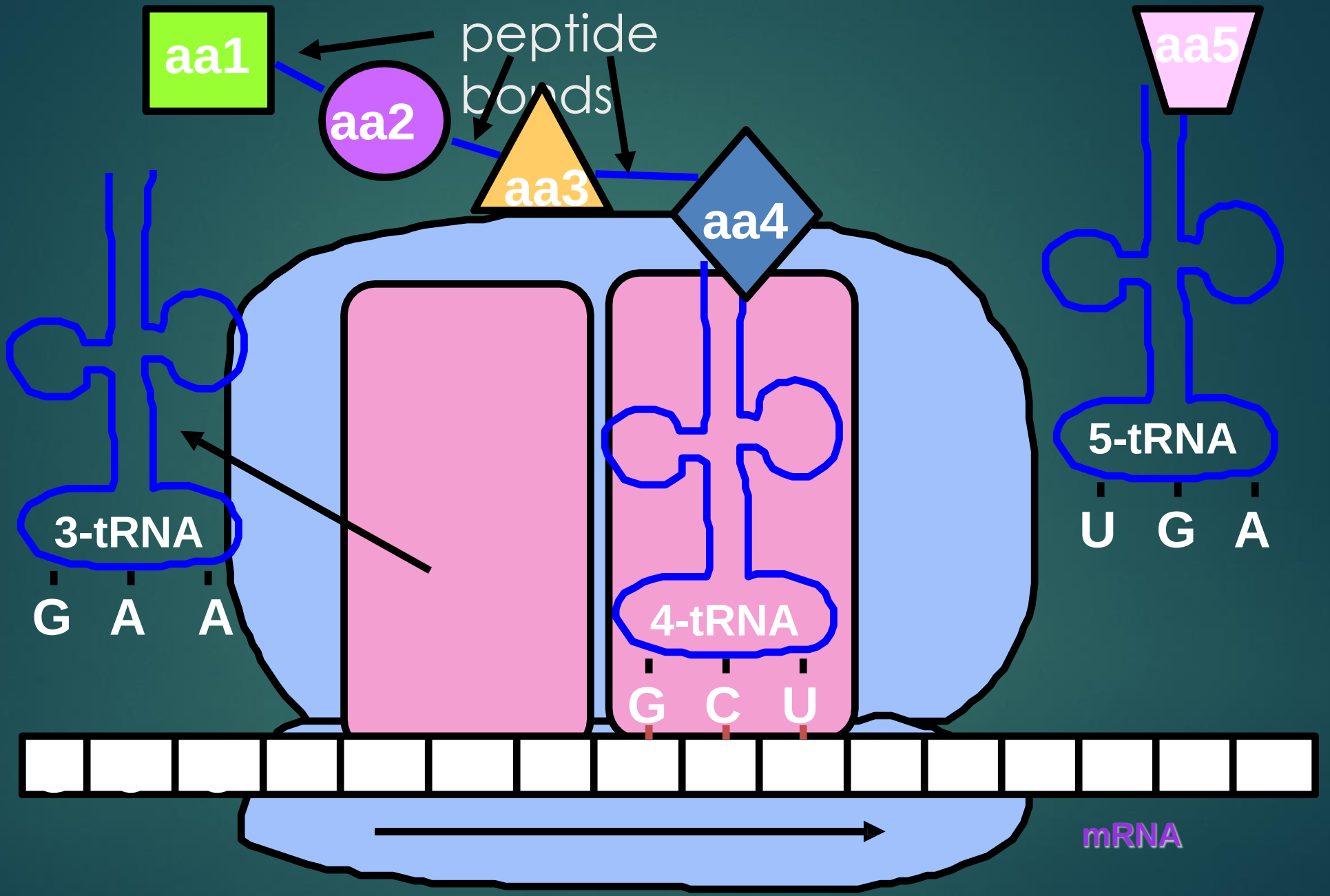
Ribosomes move over one codon


aa1
peptide bonds
aa4
aa2
aa3
4-tRNA
G C U
2-tRNA
3-tRNA
G A U
G A A
mRNA



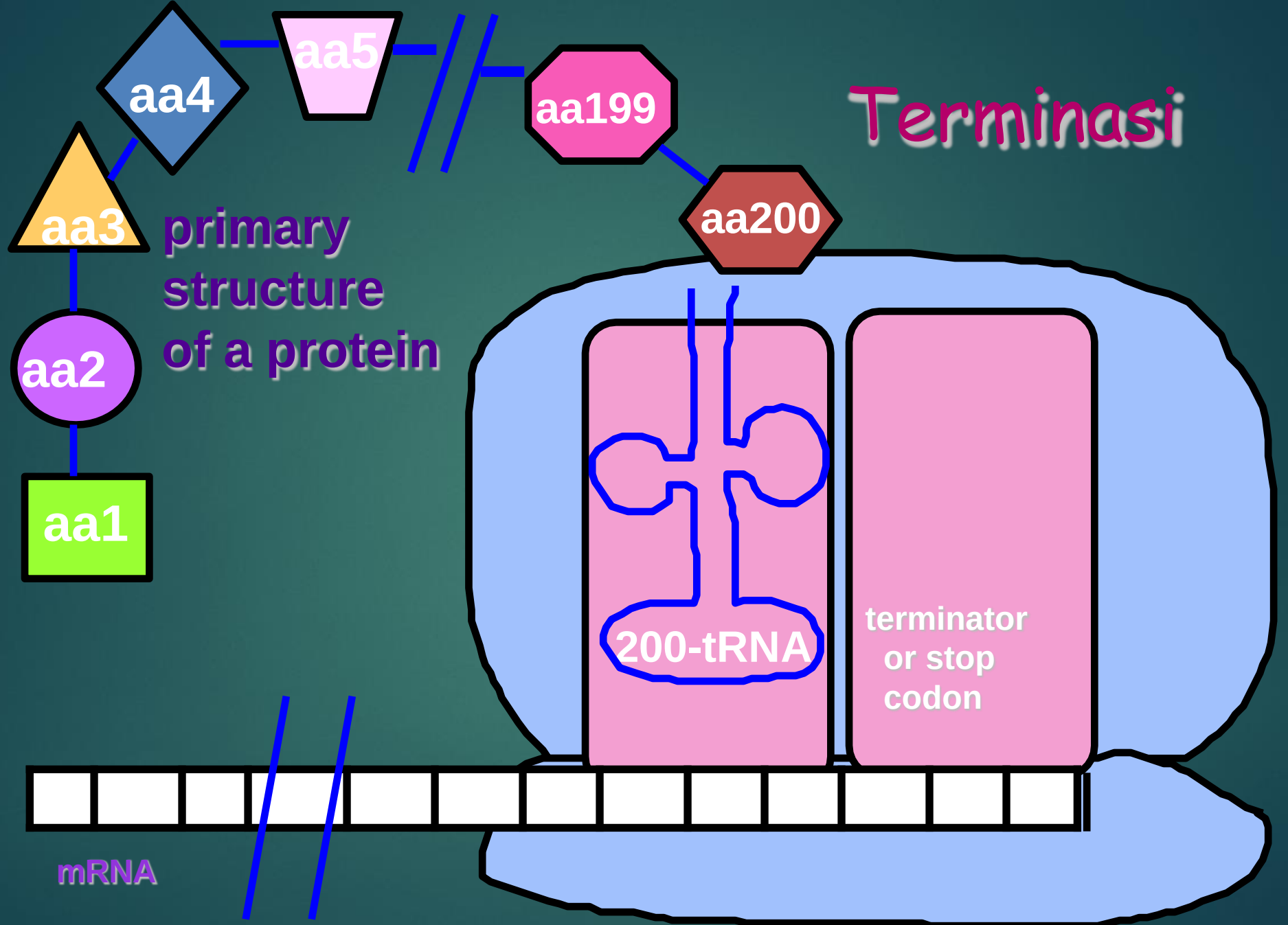
Ribosomes move over one codon


aa1
peptide
bonds
aa2
aa3
aa4
aa5
5-tRNA
U G A
3-tRNA
4-tRNA
G A A
G C U
mRNA



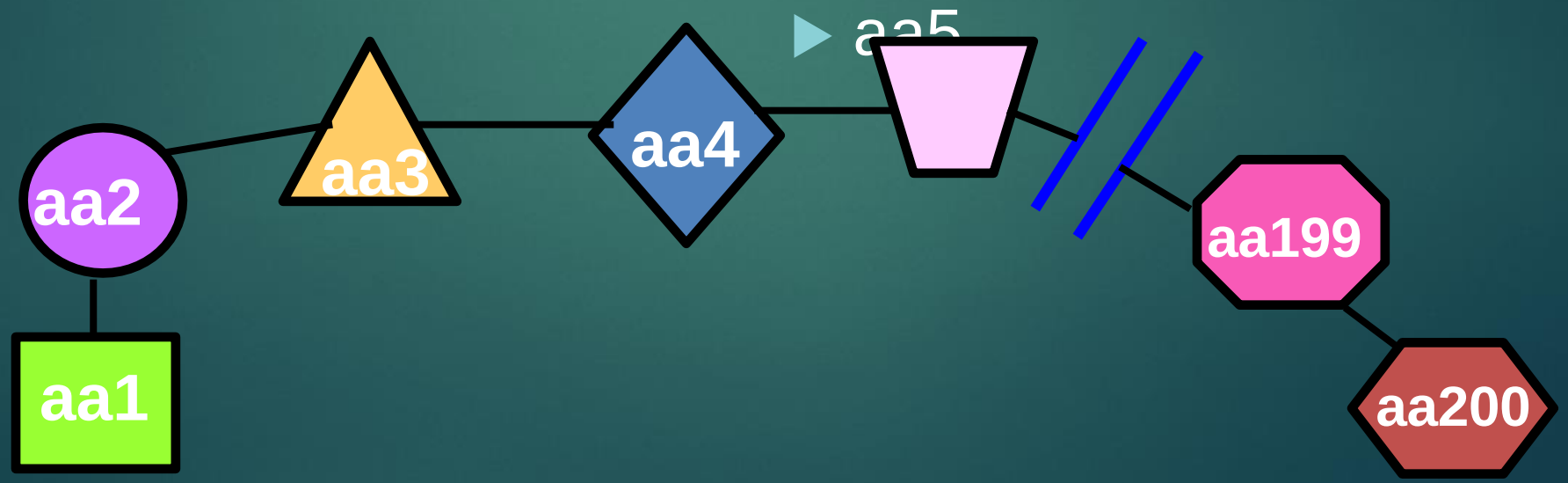
Ribosomes move over one codon

Terminasi


aa4
aa5
aa199
aa200
aa3
aa2
aa1
primary
structure
of a protein
200-tRNA
terminator
or stop
codon
mRNA

End Product - The Protein!

- Hasil akhir dr proses tsb adlh protein dg struktur primer
- Asam-asam amino yg membentuk protein /polipeptida tsb dihubungkan oleh ikatan peptida



What happens after translation?

- A newly synthesized polypeptide chain must undergo post-translational processing to generate the final protein
- **Posttranslational modifications include:**

  - Targeting to the appropriate cell compartment

  - **Folding**

  - Addition of **sugar** chains

  - Formation of **disulfide** bonds

- Posttranslational modifications start as soon as the nascent polypeptide emerges from the tunnel in large ribosomal subunit

  -That means these changes happen during translation when the peptide has NOT been finished yet and is still attached to the ribosome (cotranslationally)

Thank you