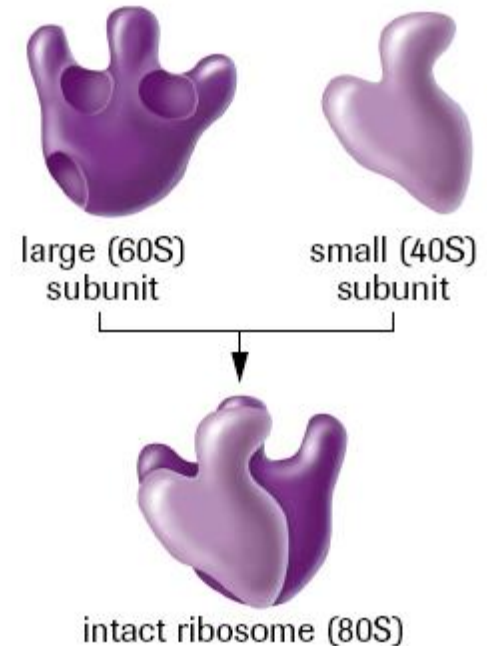


TRANSLATION

Goal: Understand the process of translating mRNA into a polypeptide

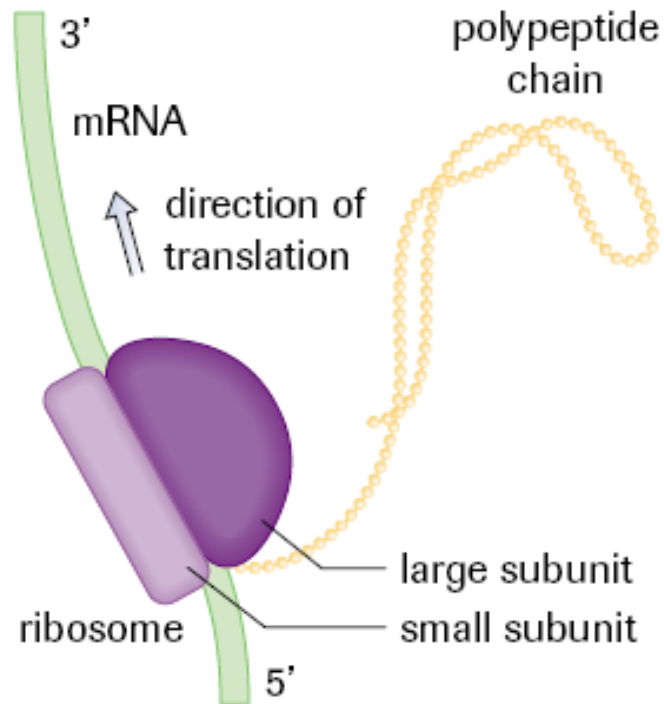
INITIATION:

- mRNA enters the cytoplasm.
- The ribosome binds to the 5' cap on mRNA.
- Ribosomes:
 - Consists of 2 subunits:
 - **large** (60S)
 - **small** (40S).
 - The 2 subunits clamp mRNA between them.



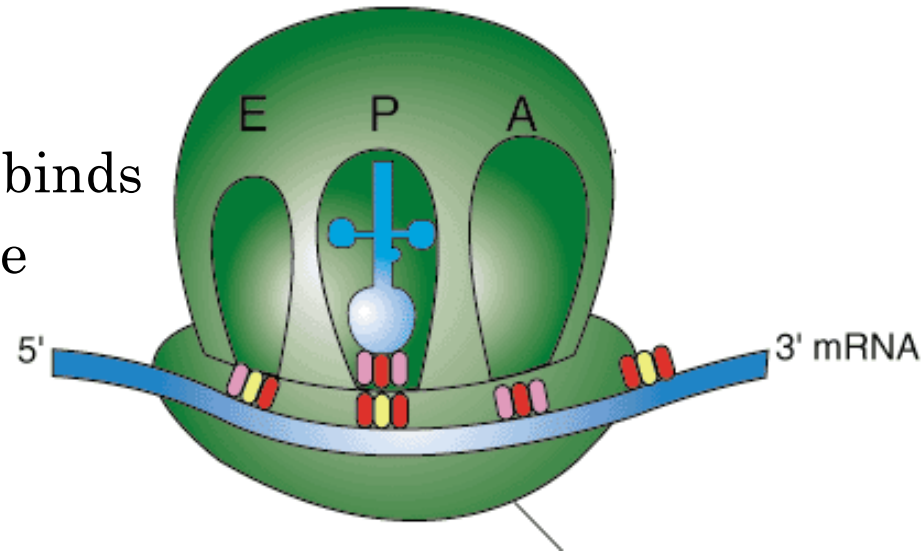
ELONGATION: RIBOSOME

- Ribosome moves along mRNA in 5' to 3' direction
- Adds new amino acid to the polypeptide chain each time a **codon** is read.



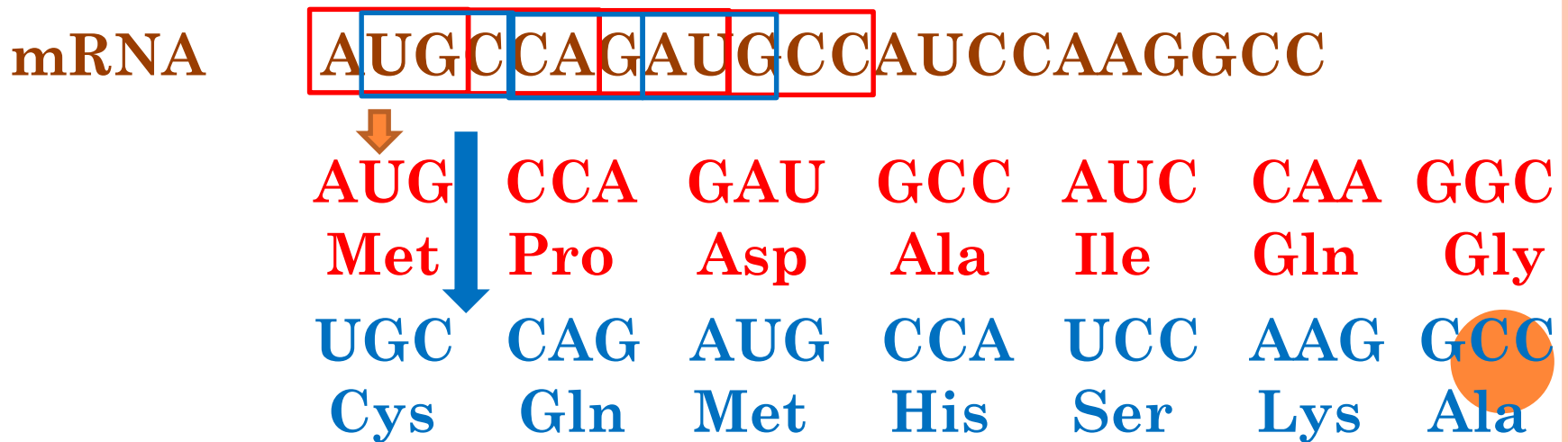
ELONGATION: RIBOSOME STRUCTURE

- **A site** – Aminoacyl site
 - Binds aminoacyl tRNA **except** for first tRNA
- **P site** – Peptide site
 - Amino acid from tRNA here binds to amino acid on tRNA in A site
- **E site** – Exit site
 - tRNA exits ribosome

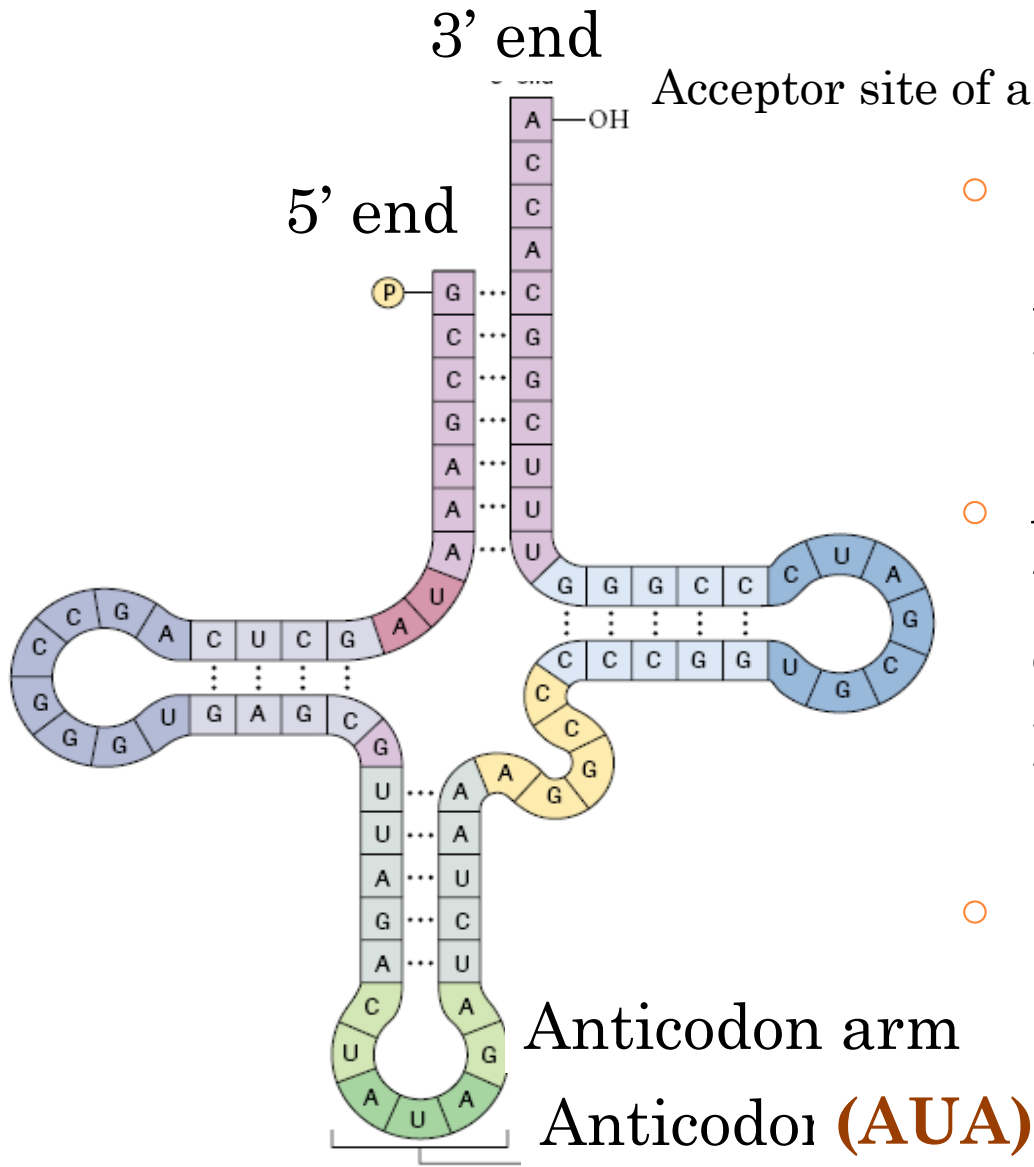


ELONGATION: READING FRAME

- A series of nucleotides read by the ribosome is called the **reading frame**.
 - The reading frame can change.



ELONGATION: TRANSFER RNA (tRNA)

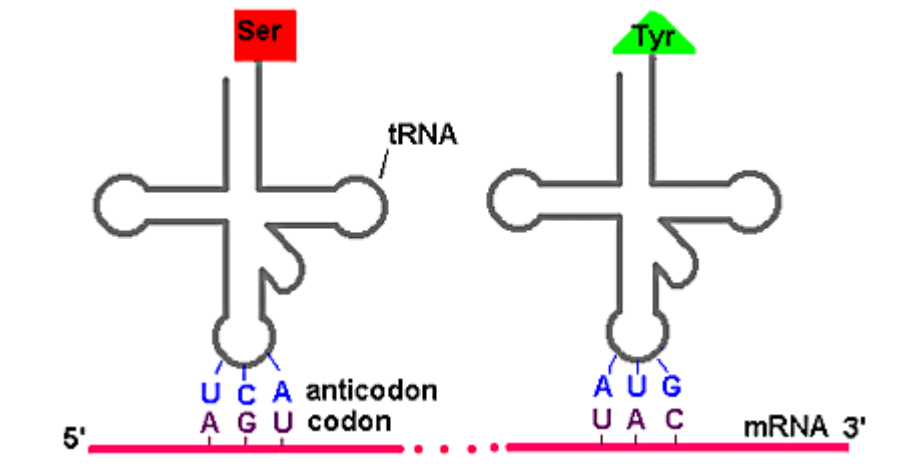


- Single-stranded nucleic acid (looks like a clover leaf).
- Anticodon recognizes the codon of mRNA (via complimentary base pairing).
- Each tRNA carries a specific amino acid.



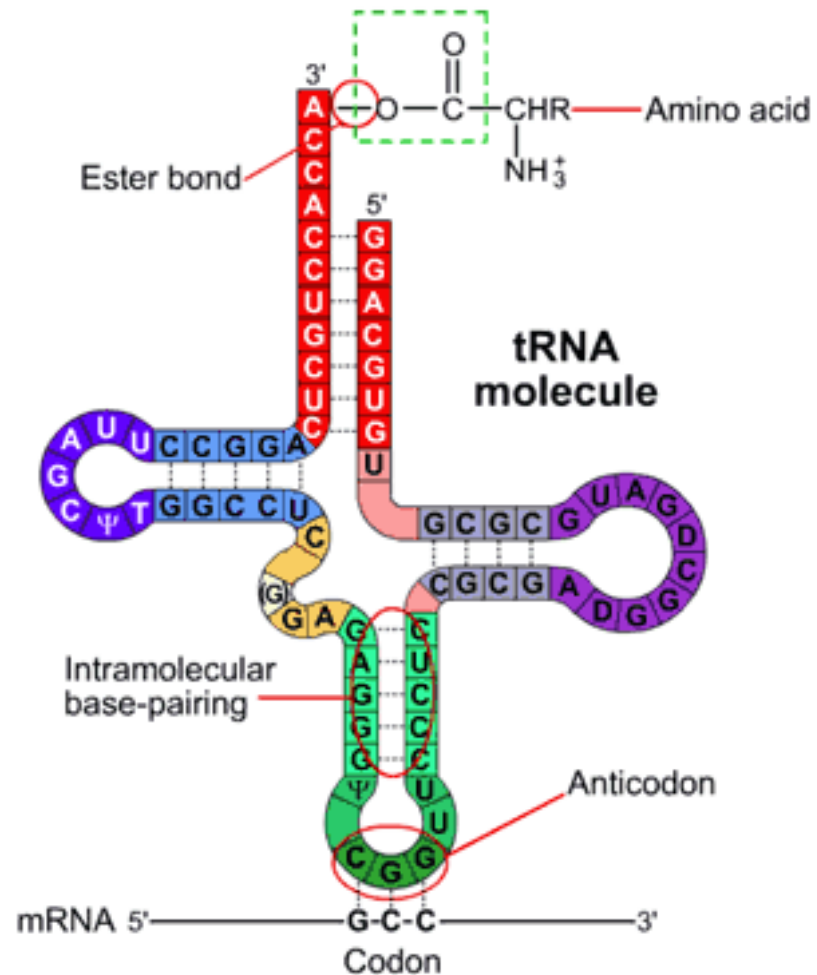
ELONGATION: ANTICODONS

- Each amino acid is coded by specific codons and **complementary** anticodons
- Ex. Anticodon (tRNA): **AAA**
Codon (mRNA):
Amino Acid:



ELONGATION: AMINOACYL-tRNA

- A tRNA molecule with its corresponding amino acid attached to its 3' end.
- Aminoacyl-tRNA synthetase catalyzes the reaction between tRNA and its amino acid.
- An enzyme for each amino acid and tRNA



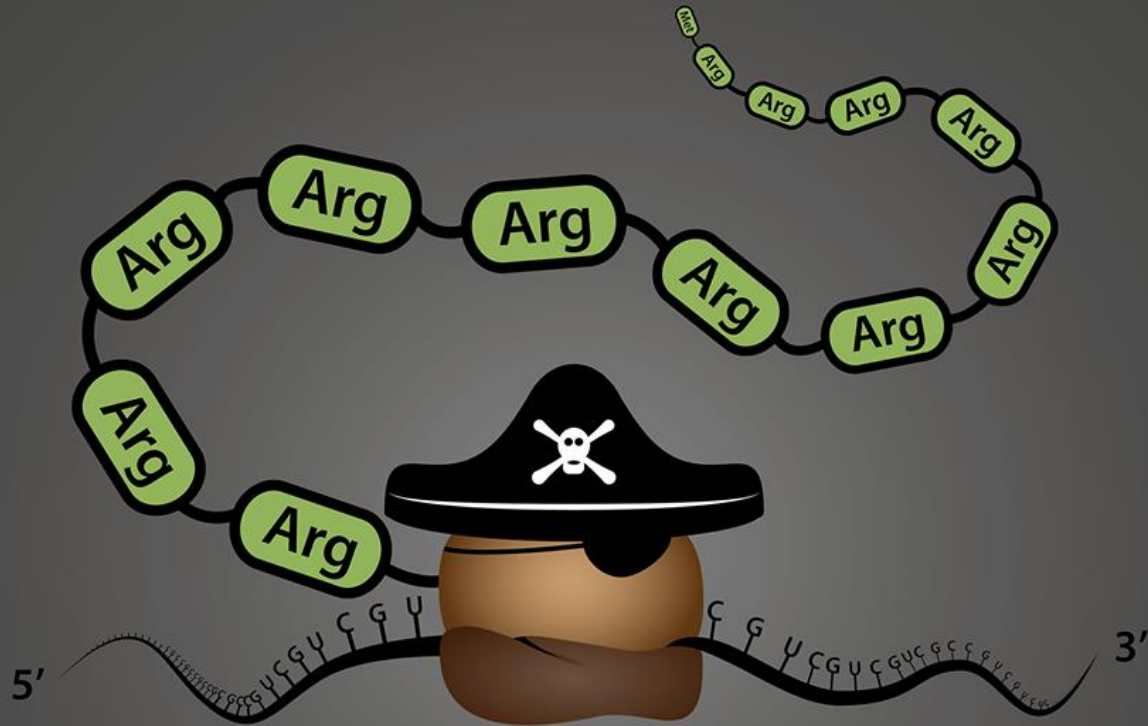
ELONGATION: WOBBLE HYPOTHESIS

- The **third base** in a codon may differ between two or more codons that code for the same amino acid.
- Redundancy increases the chance that the correct amino acid be added despite errors in mRNA.

UUA & UUG both code for leucine

	U	C	A	G
U	UUU = phe UUC = phe UUA = leu UUG = leu	UCU = ser UCC = ser UCA = ser UCG = ser	UAU = tyr UAC = tyr UAA = stop UAG = stop	UGU = cys UGC = cys UGA = stop UGG = trp





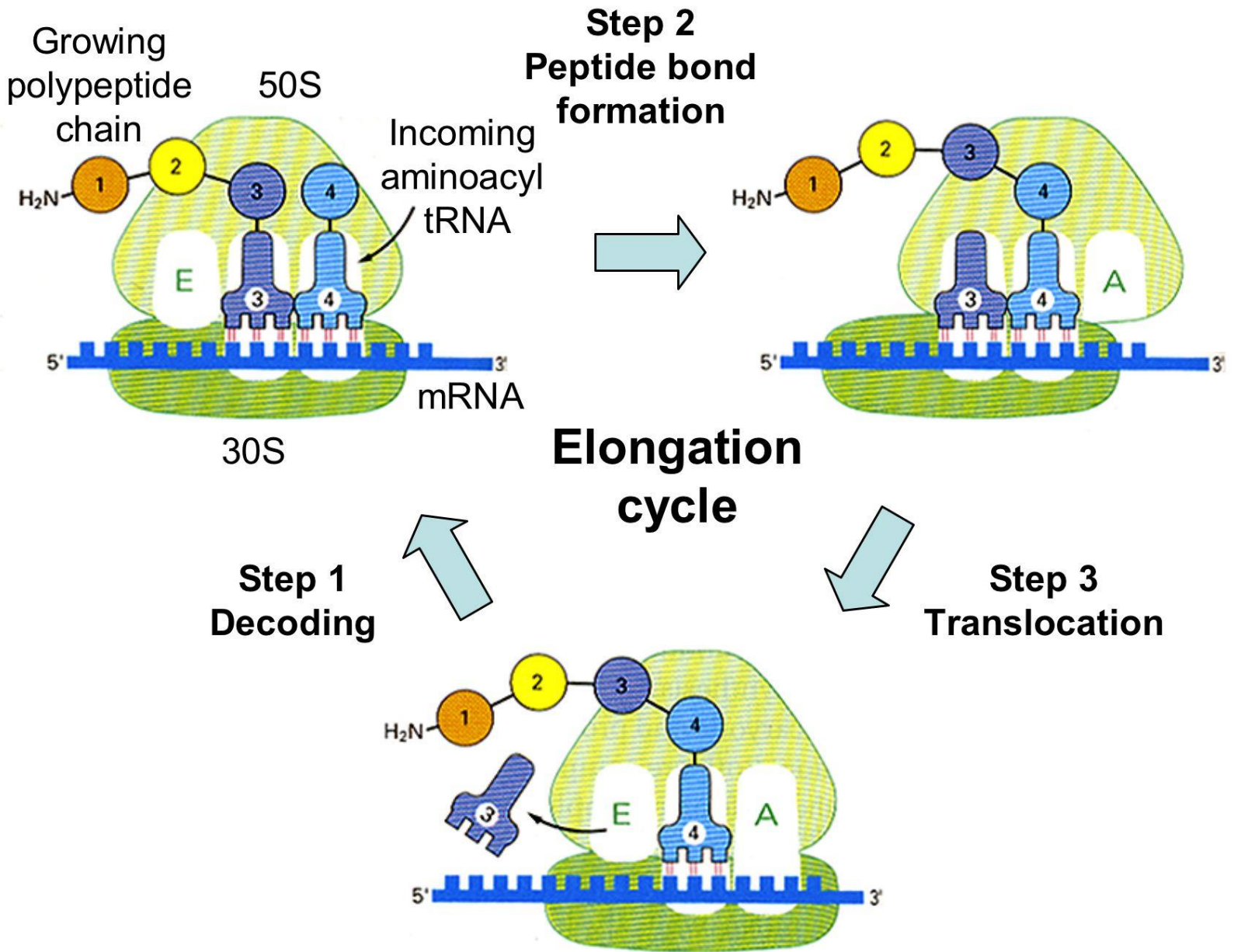
Pirate Ribosome



ELONGATION: THE STEPS

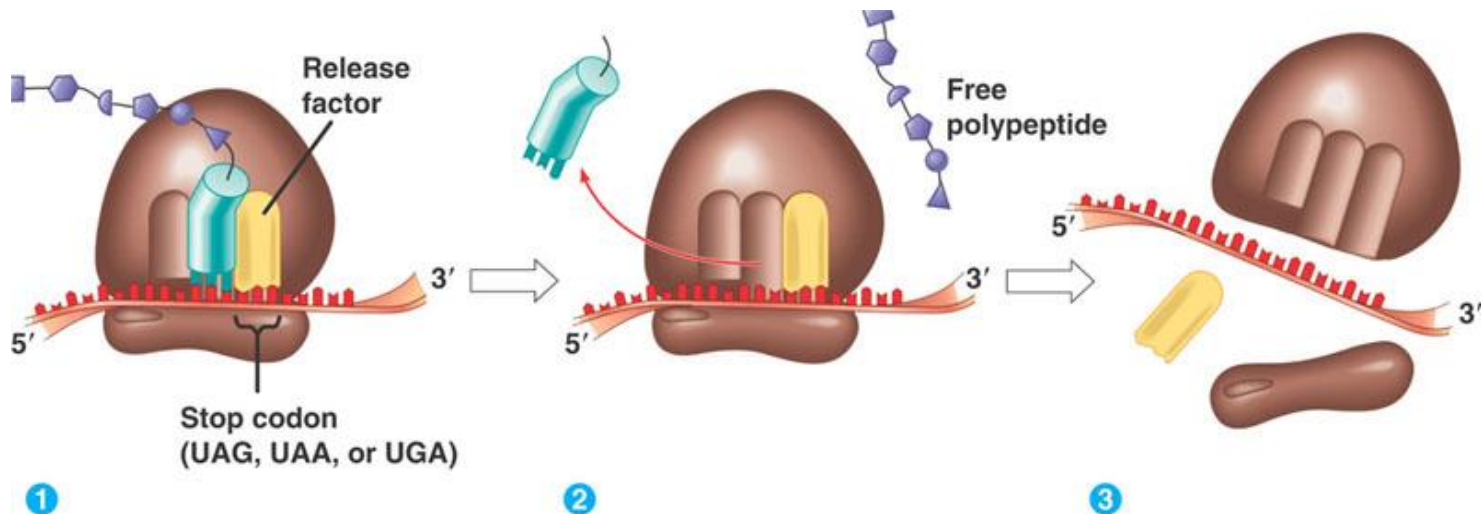
1. The start codon (*methionine, AUG*) is the first codon recognized by the ribosome.
2. Aminoacyl-tRNA carrying AUG enters the P site.
3. The next aminoacyl-tRNA enters the A site.
4. A peptide bond forms between the two amino acids.
5. The ribosome translocates over one codon.
 - tRNA in the P site is released enters E site and is released.
 - tRNA in the A site shifts to the P site.
6. The next aminoacyl-tRNA enters the A site and the process is repeated.





TERMINATION:

- Occurs when a stop codon (UGA, UAG, UAA) is read.
- A **release factor** helps remove the polypeptide chain from the ribosome
 - (tRNA without an amino acid)
- Ribosome subunits fall off the mRNA.



MODIFICATIONS

- **Glycosylation** – addition of sugars
- **Phosphorylation** – addition of phosphates
- **Enzymes** – cleave polypeptide or alter amino acids

