The Genetic Code

- The first step in decoding genetic messages is to **transcribe** a nucleotide base sequence from **DNA to mRNA.**

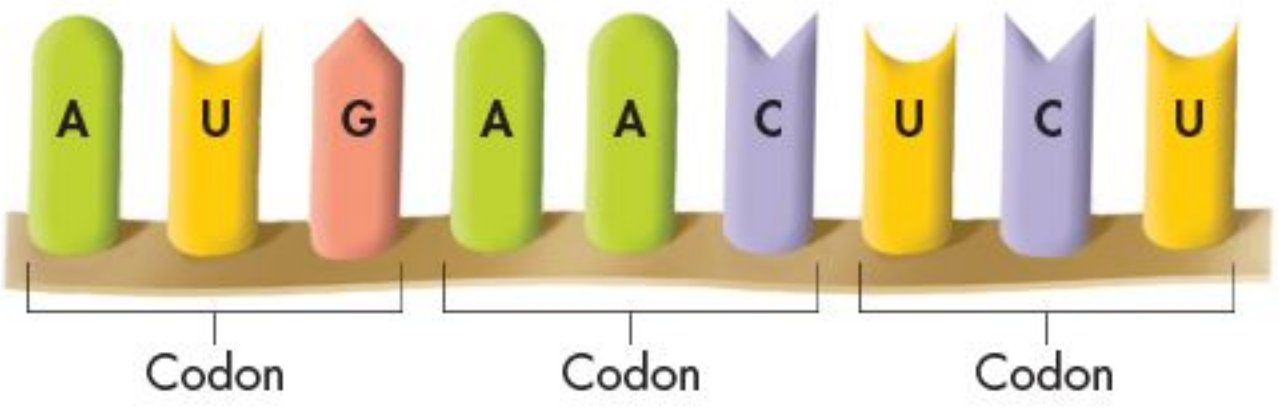
- RNA contains four different nitrogenous bases: **adenine, cytosine, guanine, and uracil.**

- These bases form a “language,” or **genetic code**.

The Genetic Code

- Each three-letter “word” in mRNA is known as a **codon.**

- A codon consists of **three consecutive bases that specify a single amino acid** to be added to the polypeptide chain.

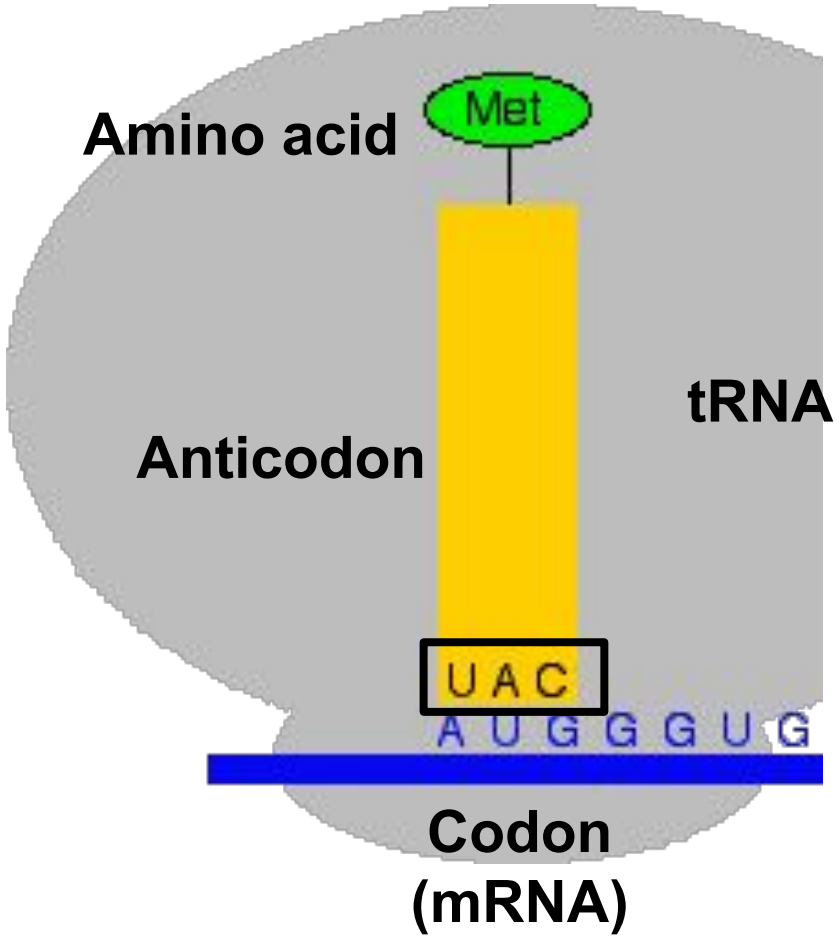


The Genetic Code

- Each tRNA molecule contains three unpaired bases on one end, called the **anticodon.**

- The anticodon is **complementary** to one **mRNA codon.**

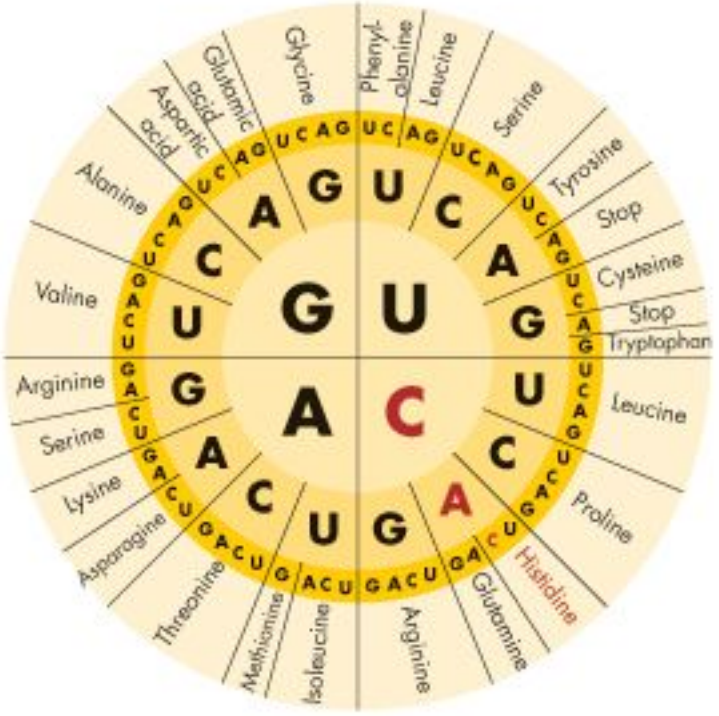
- The other end of the tRNA molecule carries **one specific amino acid.**



How to Read Codons

- Because there are **4** different bases in mRNA, there are **64** possible three-base codons in the genetic code.

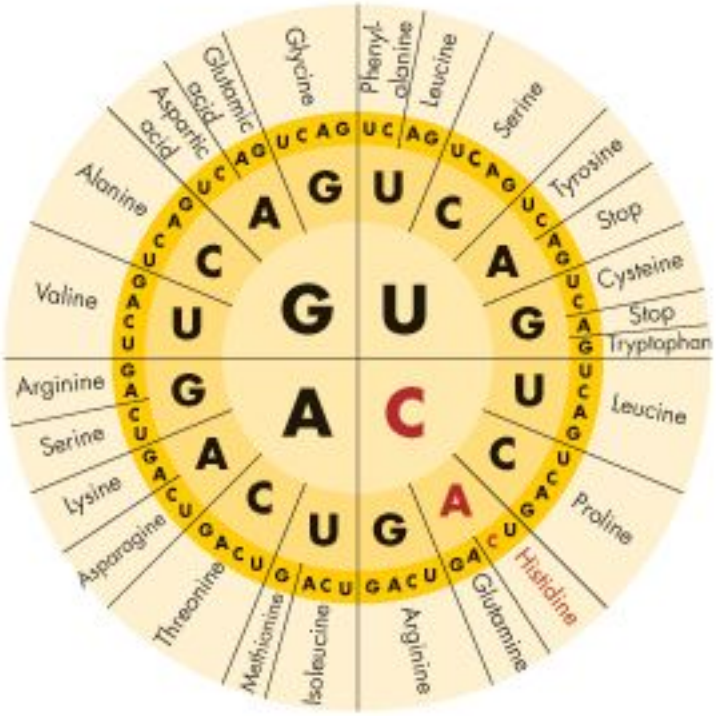
- This circular table shows the amino acid to which each of the 64 codons corresponds. To read a codon, **start at the middle of the circle and move outward.**



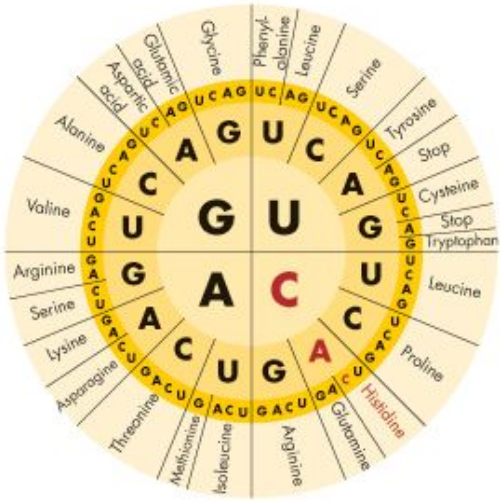
How to Read Codons

- Most amino acids can be specified by **more than one codon.**

  - For example, six different codons—UUA, UUG, CUU, CUC, CUA, and CUG—specify leucine. But only one codon—UGG—specifies the amino acid tryptophan.



Start and Stop Codons



- The genetic code has punctuation marks.

- The methionine codon **AUG** serves as the **“start” codon** for protein synthesis.

- Following the start codon, mRNA is read, **three bases at a time**, until it reaches one of three different **“stop” codons**, which end translation.

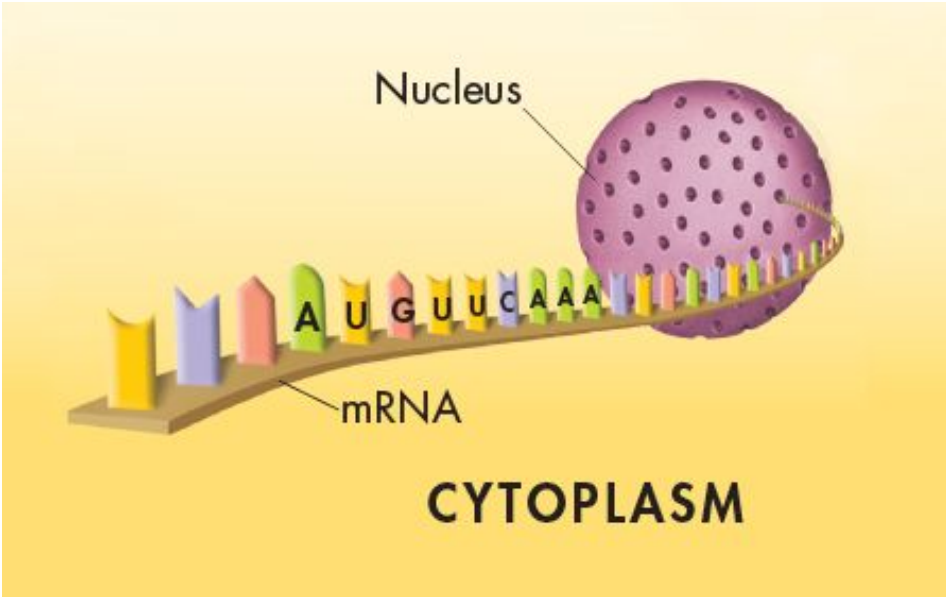
Translation

- Ribosomes use the sequence of codons in mRNA to **assemble amino acids into polypeptide chains, which make up proteins.**

- The decoding of a mRNA message into a protein is a process known as **translation.**

Steps in Translation

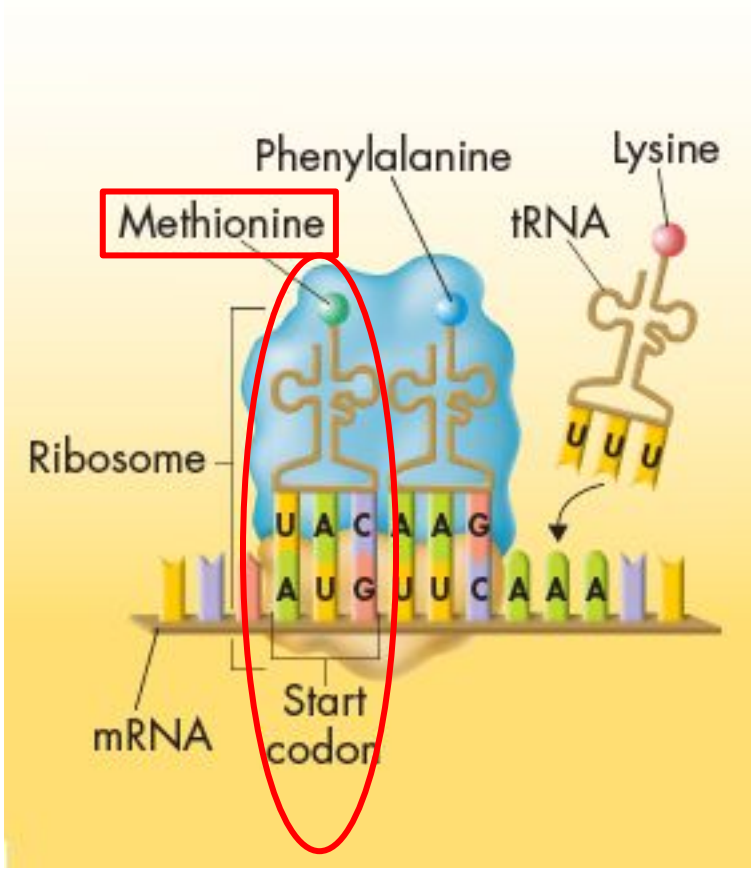
- mRNA is **transcribed in the nucleus** and then enters the **cytoplasm for translation.**
- There are three phases of translation:
  1. **Initiation**
  2. **Elongation**
  3. **Termination**



Initiation

- Translation begins when a **ribosome** attaches to a **mRNA** molecule at a **start codon**.

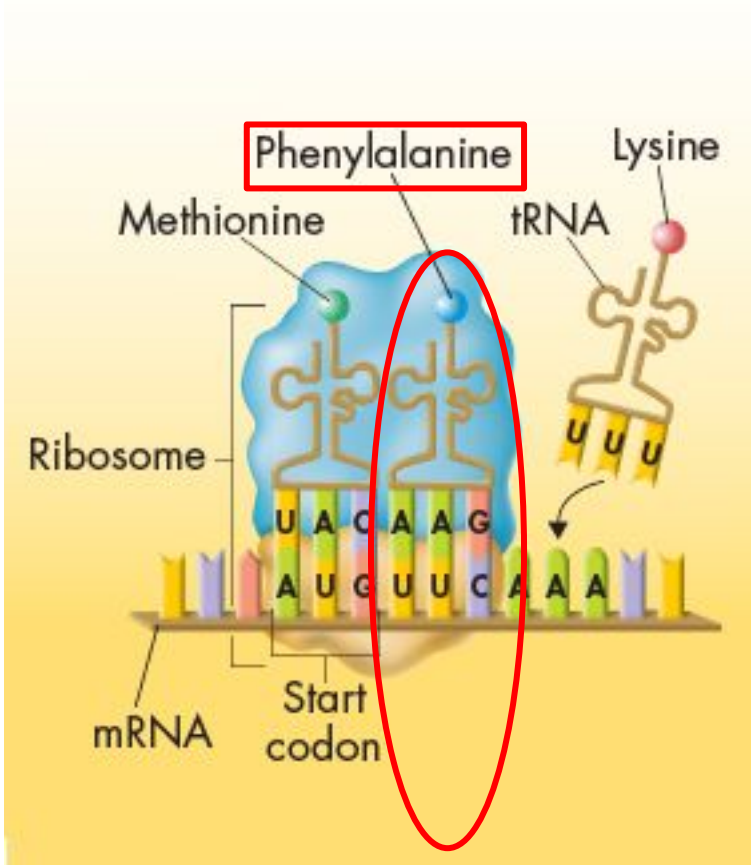
- As the ribosome reads the start codon of mRNA, it directs **tRNA** to bring the specified **amino acid, methionine,** into the **ribosome.**



Elongation

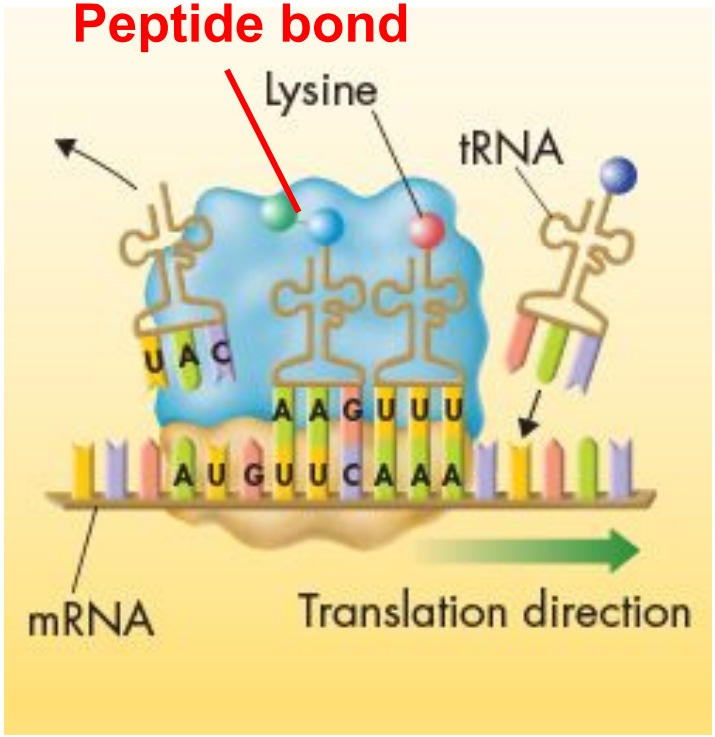
- The next **mRNA** codon at the second binding site on the ribosome is read.

- The **tRNA** molecule containing the **complementary anticodon** binds to the mRNA.



Elongation

- The ribosome helps form a **peptide bond** between the first and second **amino acids.**

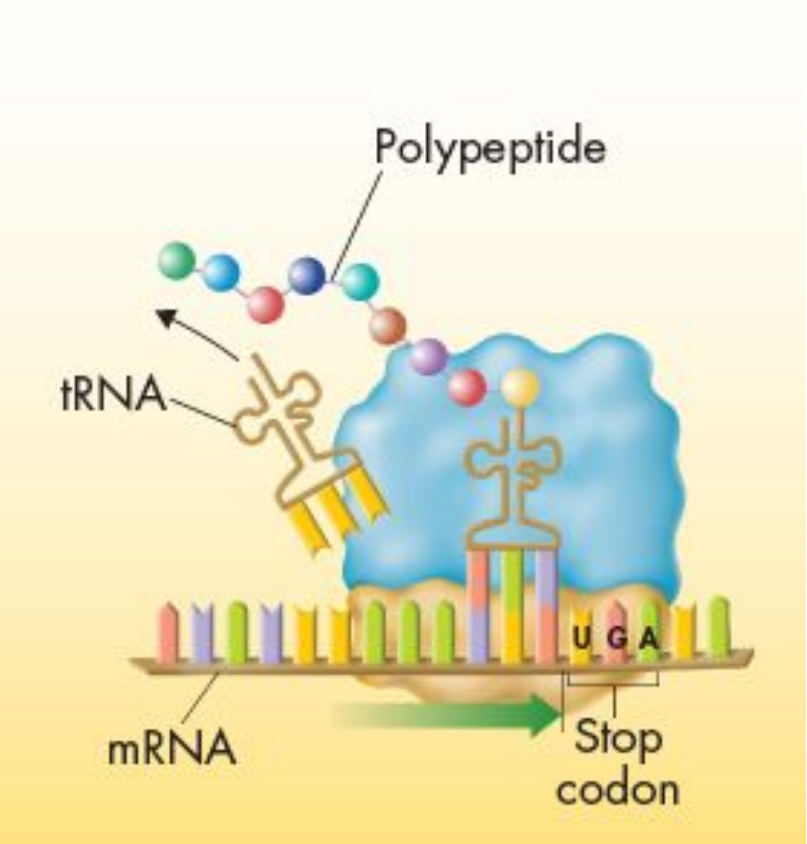


- At the same time, the bond holding the first tRNA molecule to its amino acid is **broken**.

- One at a time, the **ribosome** then attaches each **amino acid** to the growing chain, forming a **polypeptide**.

Termination

- When the ribosome reaches a stop codon, it **releases both the newly formed polypeptide chain and the mRNA molecule**, completing the process of **translation**.



Amoeba Sisters- Protein Synthesis