

# Ribosomes and Protein Synthesis



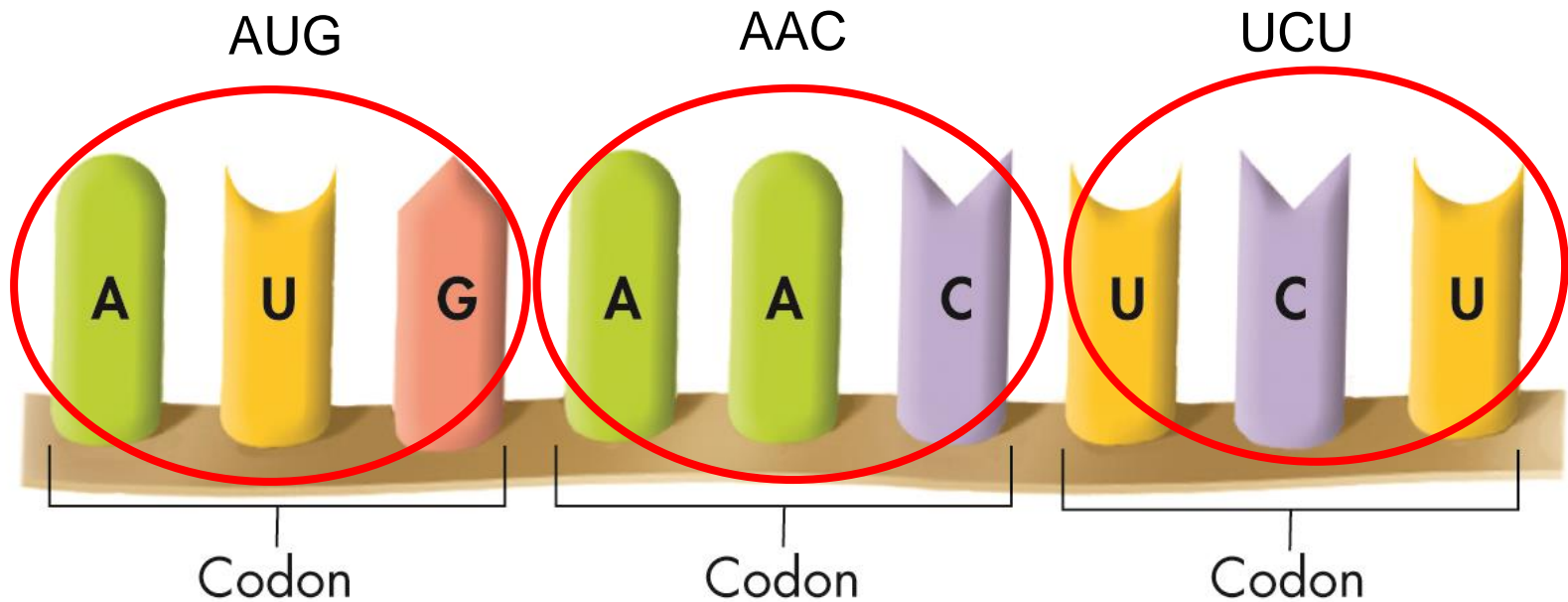
---

# The Genetic Code

- The first step in the process of decoding genetic messages is transcription (copying of a nucleotide base sequence from DNA to mRNA).
- The next step is to the assembly of a protein.
- **Polypeptides:** chains in which amino acids are joined together to make proteins
  - 20 different amino acids
  - The specific order of the amino acids determines the shape, chemical properties, and function of the protein
- **Genetic code:** the four bases of RNA form a kind of language with just 4 letters: A, C, G, and U

# The Genetic Code: Codons

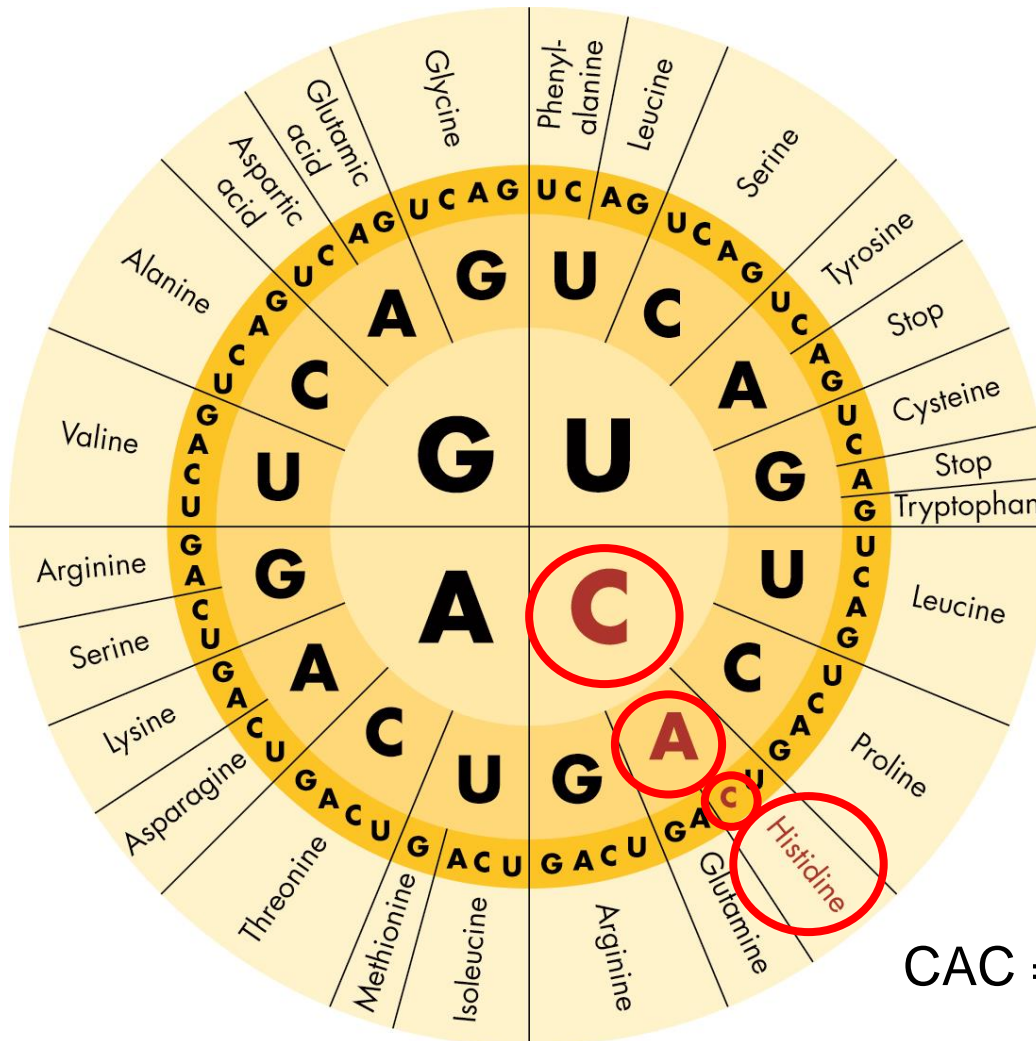
- The genetic code is read three bases at a time. Each “word” of the code is three bases long and corresponds to a single amino acid.
- A **codon** is a group of three nucleotide bases in mRNA that specifies a single amino acid to be added to the polypeptide chain.





# Reading Codons

Start at the middle of the circle with the first letter of the codon and move outward.

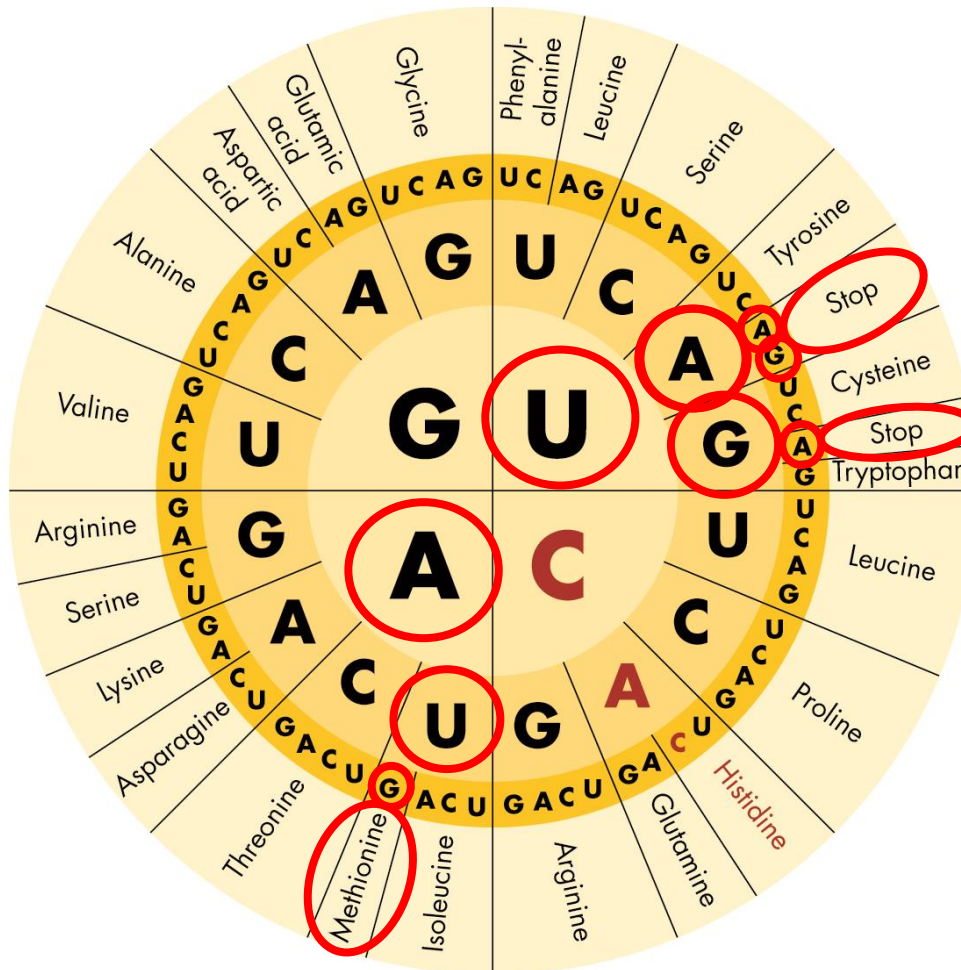


CAC = Histidine



# Start and Stop Codons

The methionine codon AUG serves as the “start” codon for protein synthesis. There are three “stop” codons.



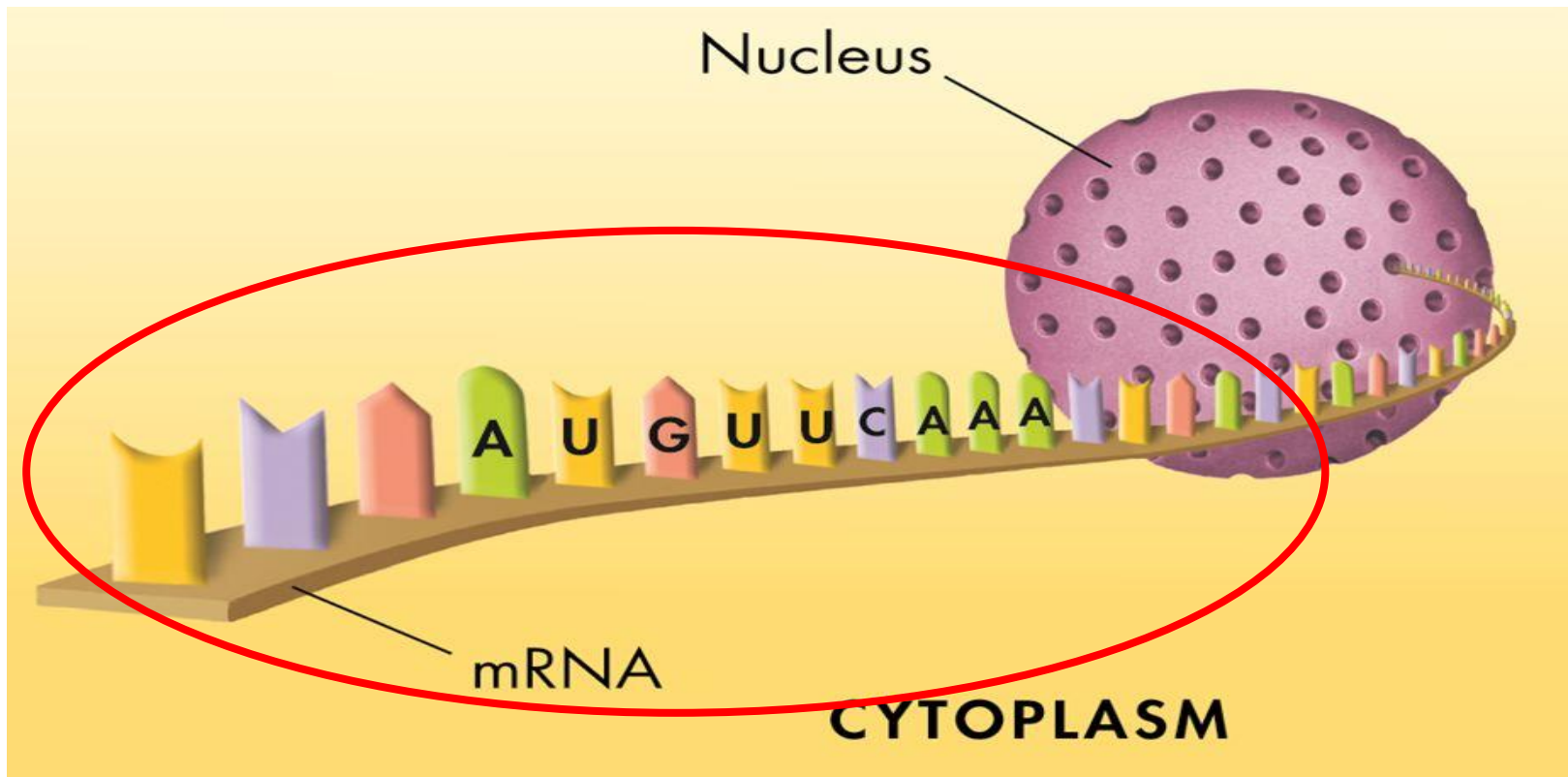
AUG =  
methionine  
= “start”  
codon

UAA, UAG,  
and UGA  
are “stop”  
codons

Just as we use  
punctuation in  
our sentences,  
codons are  
used to start  
and stop in  
protein  
making.

# Translation

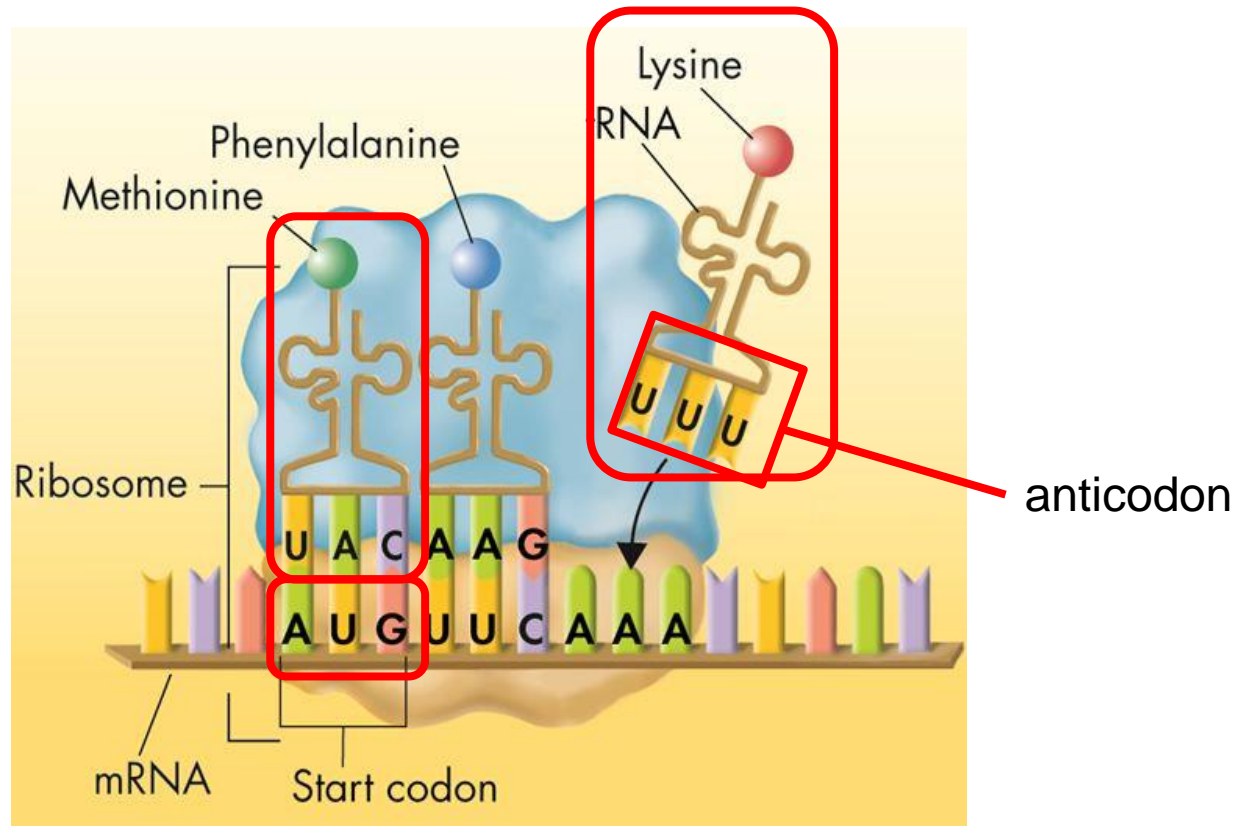
- **Translation:** the decoding of an mRNA message into a protein
  - Ribosomes use the sequence of codons in mRNA to assemble amino acids into polypeptide chains



# Translation: Transfer RNA

Translation starts when a ribosome attaches to an mRNA molecule. Then, tRNA molecules, carrying amino acids with them, bind to mRNA codons.

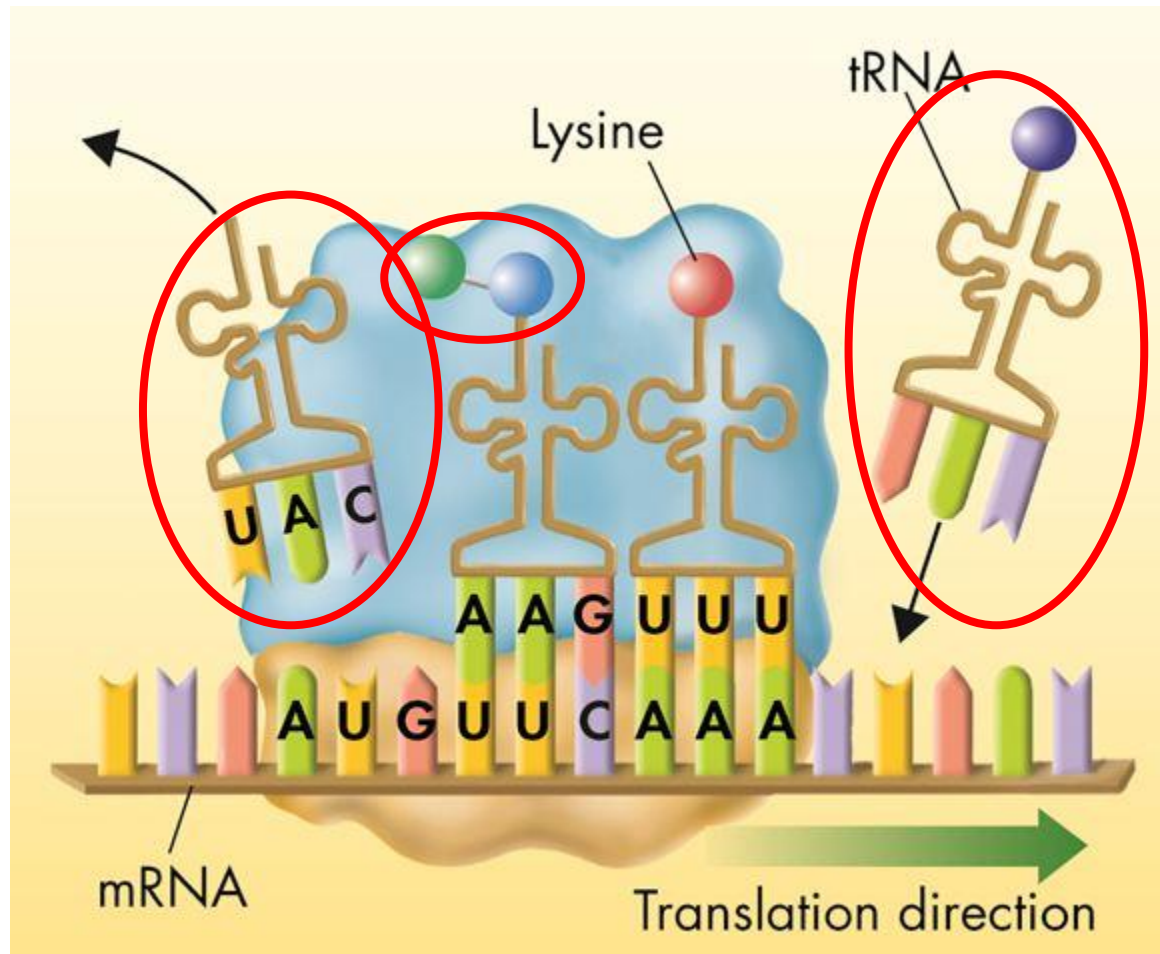
**Anticodon:** group of three bases on a tRNA molecule that are complementary to the three bases of a codon of mRNA





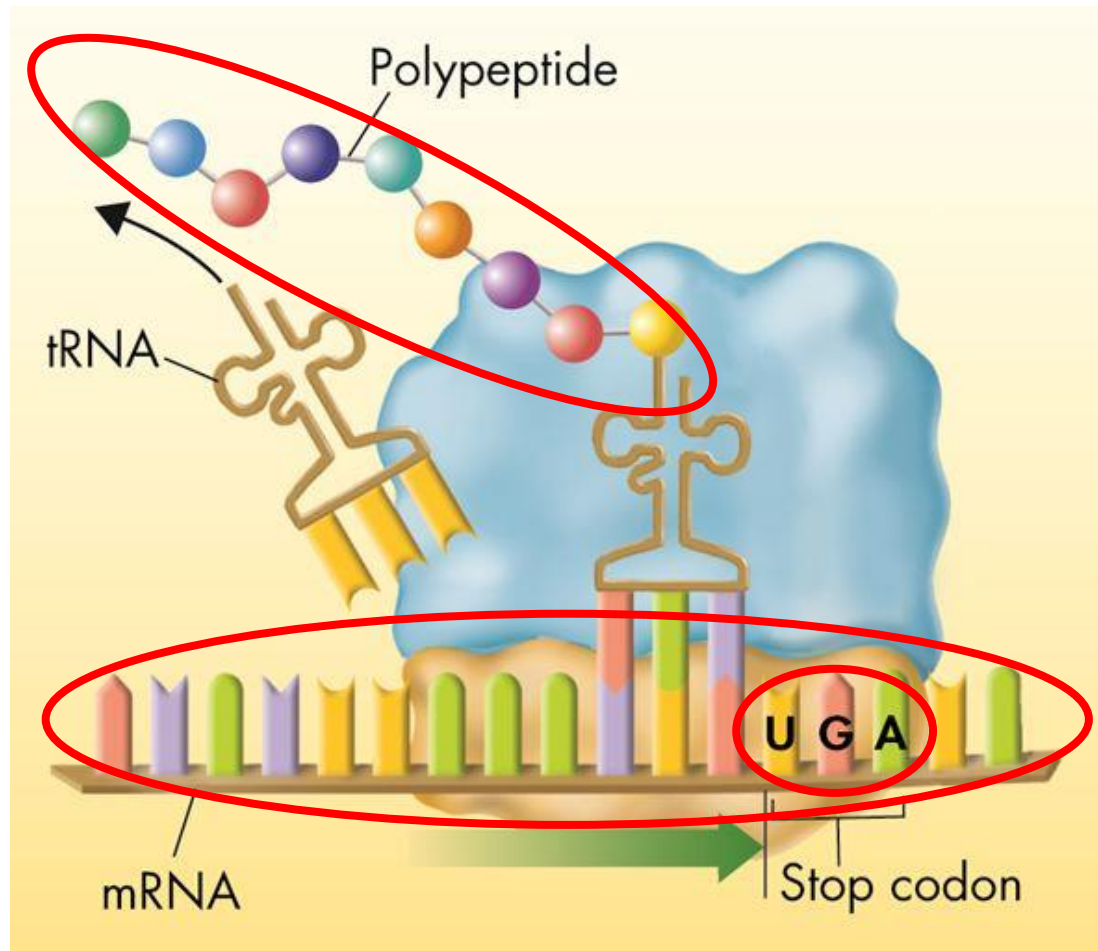
# Translation: The Polypeptide Assembly

The ribosome helps form a peptide bond. It breaks the bond holding the first tRNA molecule to its amino acid.



# Translation: Completing the Polypeptide

The ribosome reaches a stop codon, releasing the newly synthesized polypeptide and the mRNA molecule, completing the process of translation.



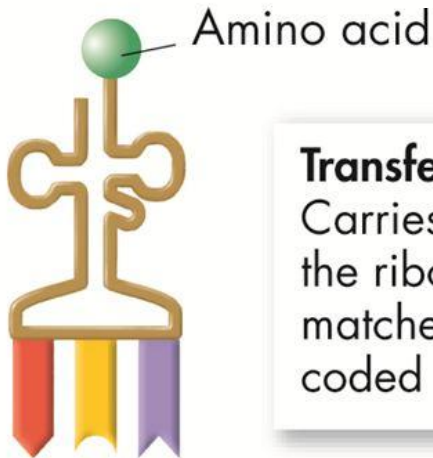
# The Roles of RNA in Translation

All three major forms of RNA—mRNA, tRNA, and rRNA—are involved in the process of translation.



## Messenger RNA

Carries instructions for polypeptide synthesis from nucleus to ribosomes in the cytoplasm.



## Transfer RNA

Carries amino acids to the ribosome and matches them to the coded mRNA message.



**rRNA** hold ribosomal protein in place and carry out chemical reactions that join amino acids together

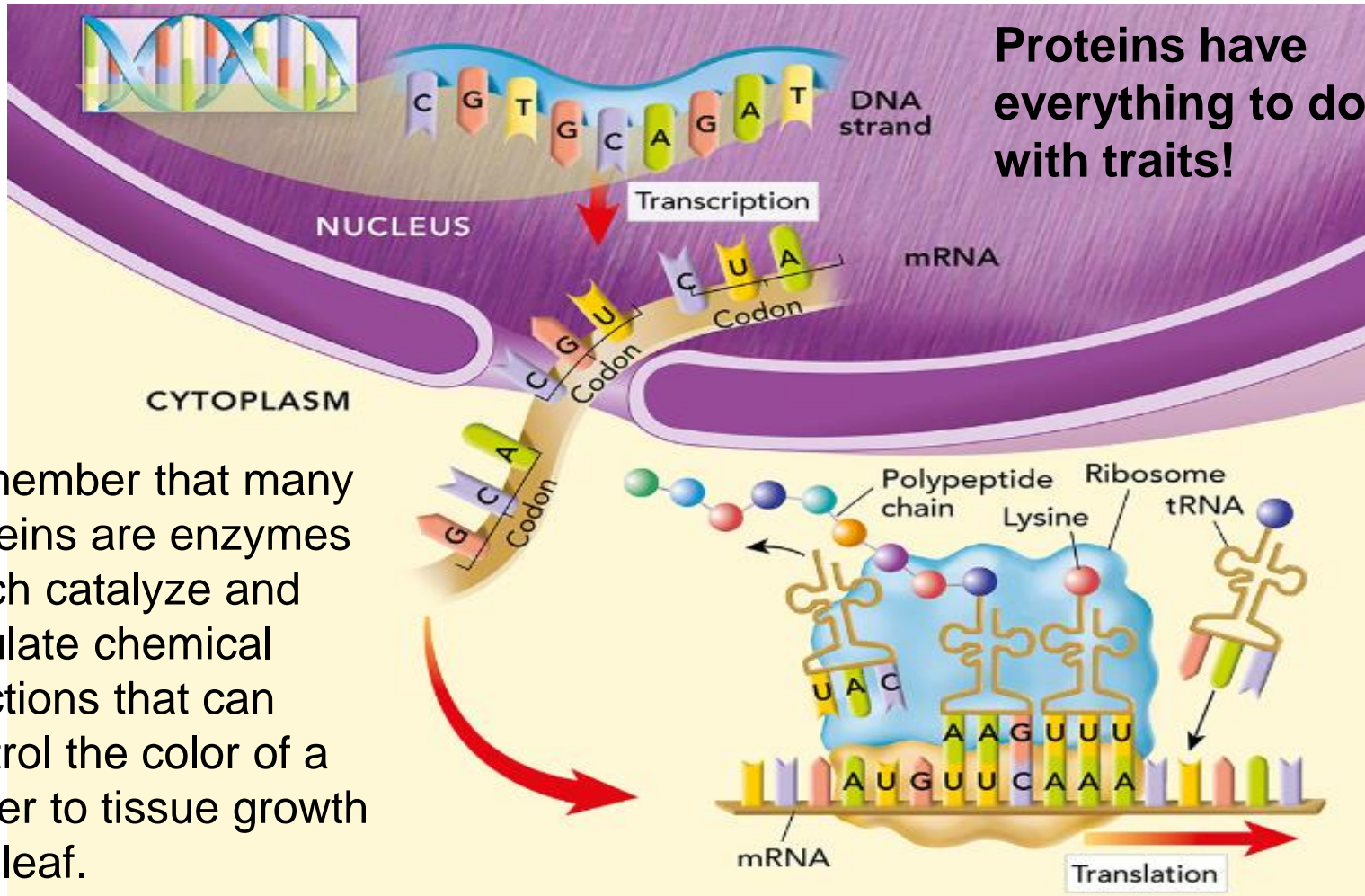
Ribosome

## Ribosomal RNA

Forms an important part of both subunits of the ribosome.

# Molecular Genetics

The central view of molecular biology is that information is transferred from DNA to RNA to protein.





# Gene Expression

When a gene (segment) of DNA code is used to build a protein, scientists say that gene has been expressed.

Molecular biology provides a way to understand the links between genes and the characteristics they influence.

All life displays unity at life's most basic level, the biology of a gene.

