

12–3 RNA and Protein Synthesis

Genes are coded DNA instructions that control the production of proteins.

Genetic messages can be decoded by copying part of the nucleotide sequence from DNA into RNA.

RNA contains coded information for making proteins.

The Structure of RNA

RNA consists of a long single strand of nucleotides.

RNA nucleotide is made up of:

- 1) 5-carbon sugar- Ribose
- 2) phosphate group
- 3) nitrogenous base.

There are three main differences between RNA and DNA:

- The sugar in RNA is ribose instead of deoxyribose.
- RNA is generally single-stranded.
- RNA contains uracil in place of thymine.

What are the three main types of RNA?

Types of RNA



There are three main types of RNA:

- **messenger RNA**
- **ribosomal RNA**
- **transfer RNA**

Messenger RNA (mRNA) carries copies of instructions for assembling amino acids into proteins.

Ribosomes are made up of proteins and **ribosomal RNA (rRNA)**.

During protein construction, **transfer RNA (tRNA)** transfers each amino acid to the ribosome.

Protein Synthesis

Protein Synthesis is composed of 2 parts:

- 1) Transcription
- 2) Translation

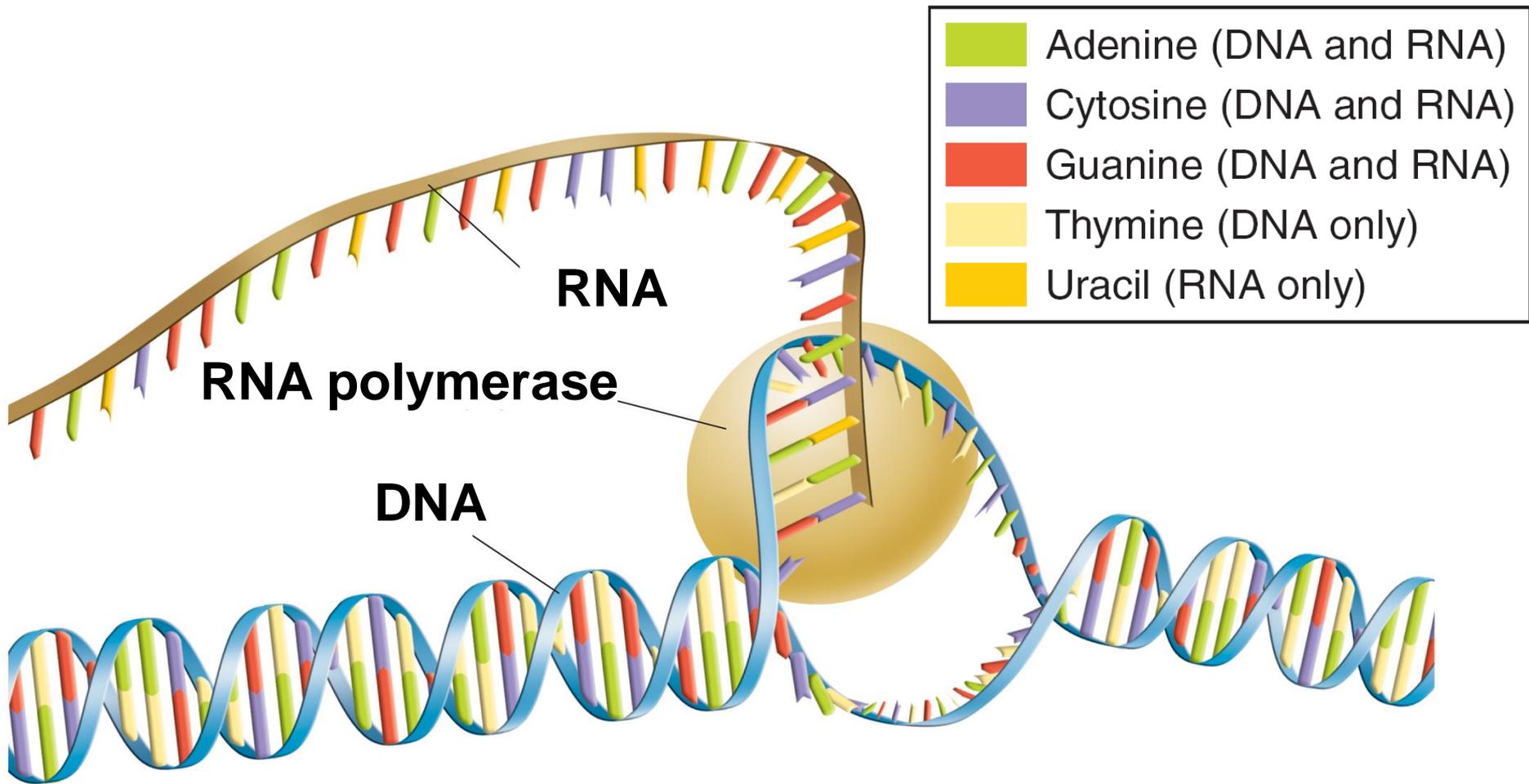
What is transcription?



During transcription, RNA polymerase binds to DNA and separates the DNA strands.

RNA polymerase then uses one strand of DNA as a template to assemble nucleotides into a strand of RNA.

Transcription

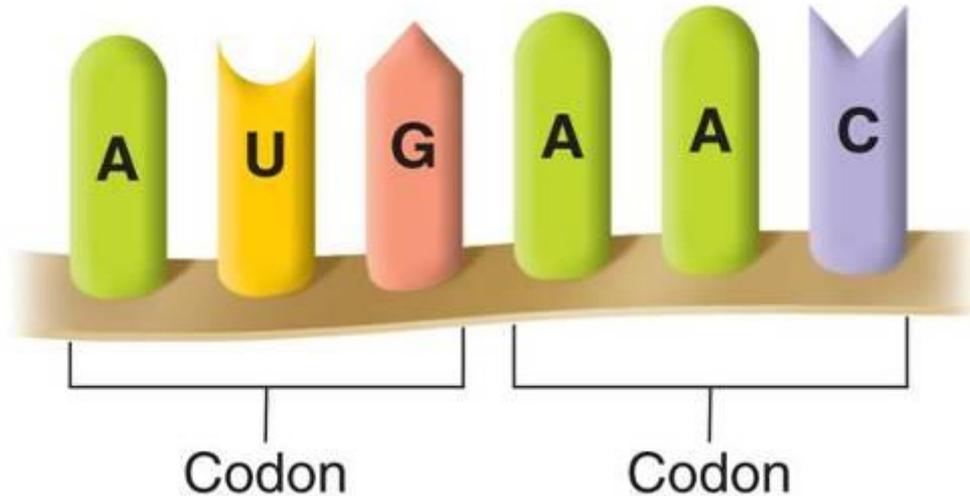


The Genetic Code

The genetic code is the “language” of mRNA instructions.

The code is written using four “letters” (the nitrogenous bases: A, U, C, and G).

Codon- 3 consecutive nucleotides on mRNA



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- Each codon specifies a particular amino acid that is to be placed on the polypeptide chain.
- Some amino acids can be specified by more than one codon.

The AUG can either specify for the amino acid methionine or serve as a “start” codon for protein synthesis.

There are three “stop” codons that signify the end of a polypeptide.

What is translation?

Translation

Translation is the decoding of an mRNA message into a polypeptide chain (protein).

Translation takes place on ribosomes.



During translation, the cell uses information from messenger RNA to produce proteins.

Translation of mRNA occurs at the ribosome.

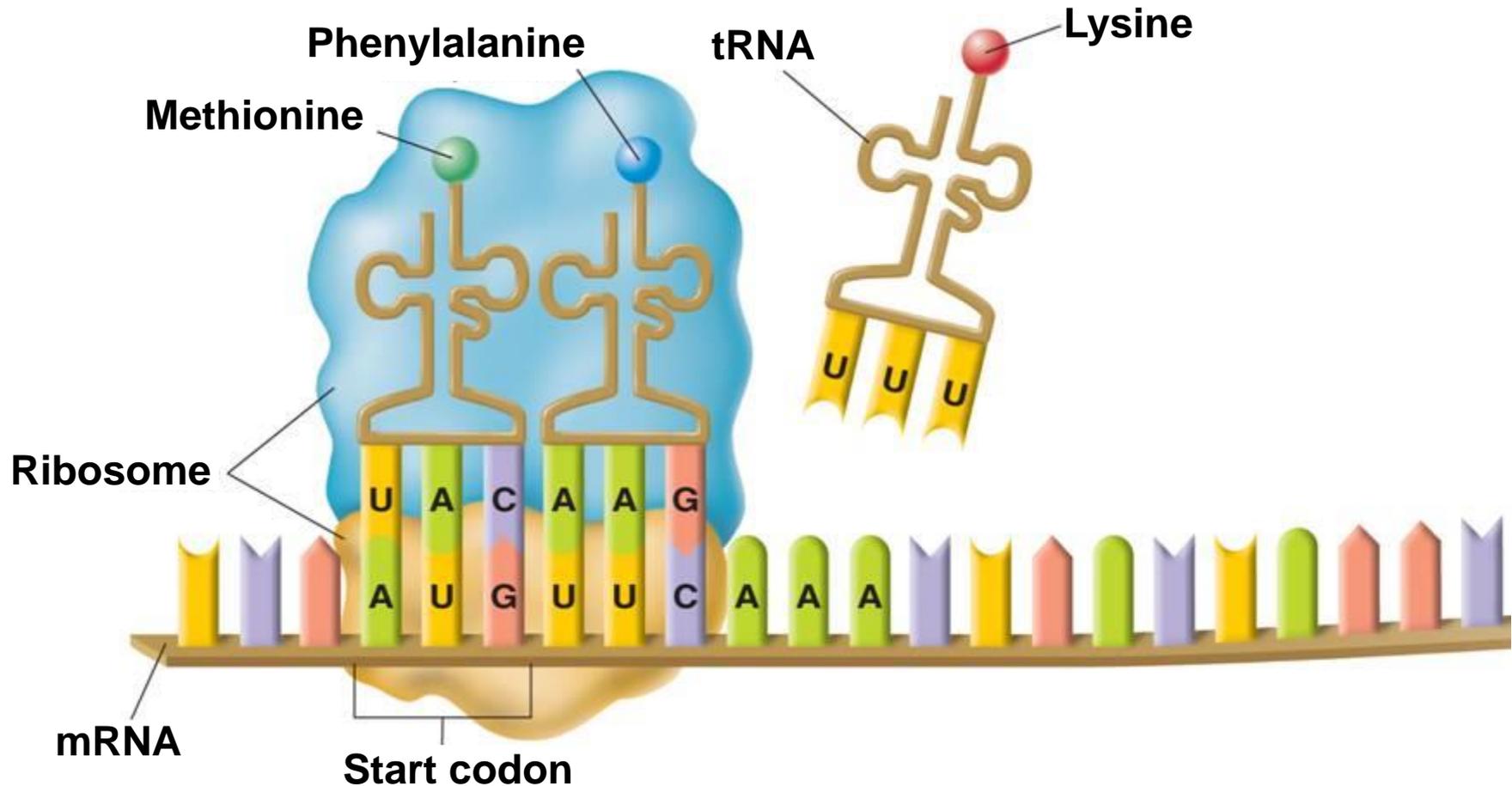
In the ribosome, codons of mRNA molecule bind to anticodons of tRNA.

Anticodons are a 3 nucleotide complementary to an mRNA codon.

Each tRNA molecule carries only one kind of amino acid.

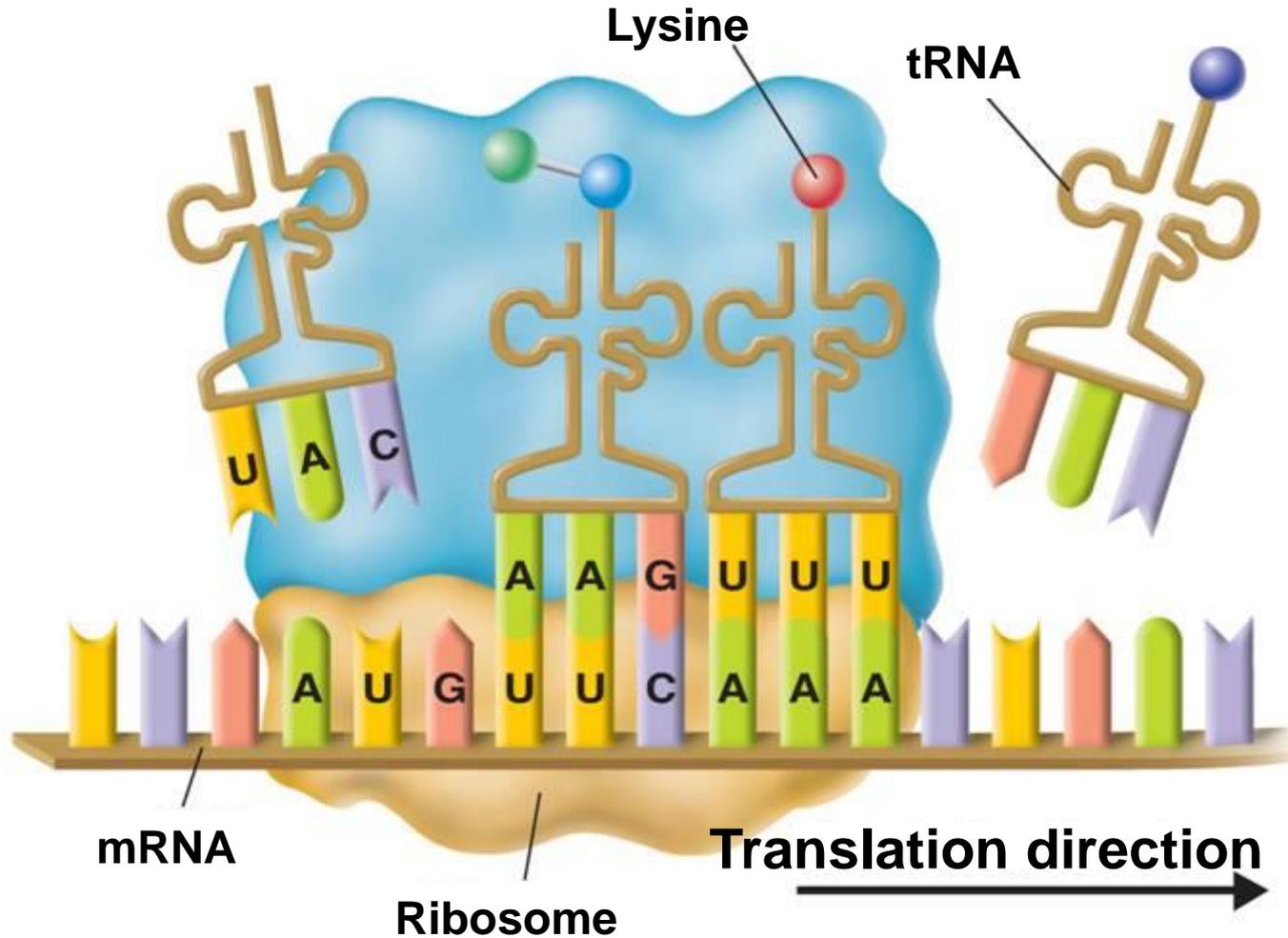
Translation

The ribosome binds new tRNA molecules and amino acids as it moves along the mRNA.



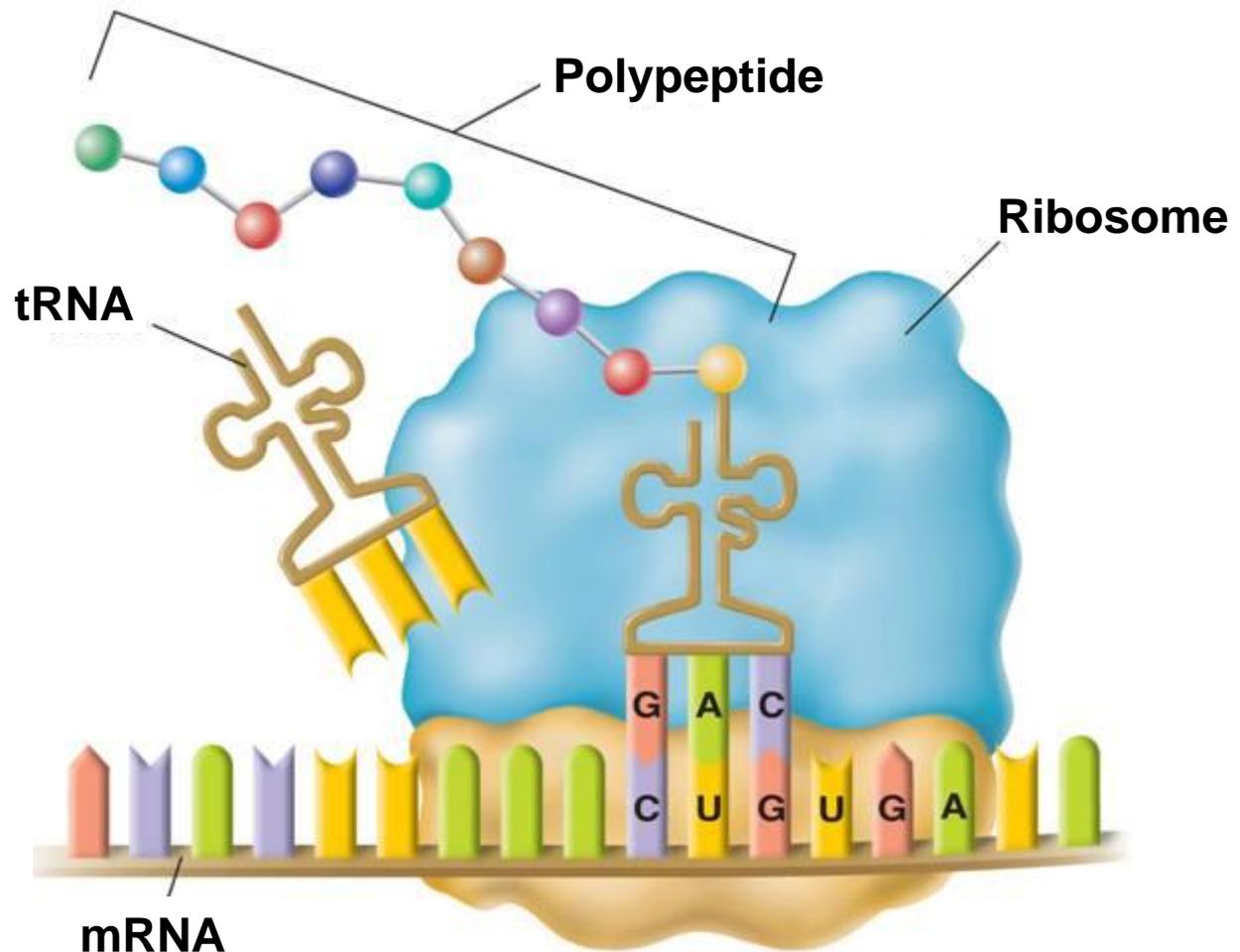
Translation

Amino acids link together to form proteins.



Translation

The process continues until the ribosome reaches a stop codon.



The Roles of RNA and DNA

The cell uses the DNA “master plan” to prepare RNA “blueprints.” The DNA stays in the nucleus.

The RNA molecules go to the protein building sites in the cytoplasm—the ribosomes.

Central Dogma

DNA → RNA → Proteins

Genes and Proteins

Genes contain instructions for assembling proteins.

Many proteins are enzymes for reactions.

Proteins are each specifically designed to build or operate a component of a living cell.

Genes and Proteins

The sequence of bases in DNA is used as a template for mRNA.

The codons of mRNA specify the sequence of amino acids in a protein.

