Protein Synthesis, Part 1: Transcription

by Sophia

WHAT'S COVERED

In this lesson, you will learn about the process of transcription and its role in protein synthesis. Specifically, this lesson will cover:

1. Transcription

The path from genes to proteins involves two steps:

- Transcription
- Translation

Transcription is the first step in **protein synthesis**. In transcription, a single strand of RNA is assembled using the DNA as a template. You can think of your DNA as the reference section of a library: It has all the "recipes" for making every component your cell needs, so it's really important. It needs to be protected, so it never leaves the nucleus (just as reference books can't be checked out of the library).

TERMS TO KNOW

Transcription
The process of converting DNA into RNA.

Protein Synthesis
The formation of proteins by using information stored in DNA.

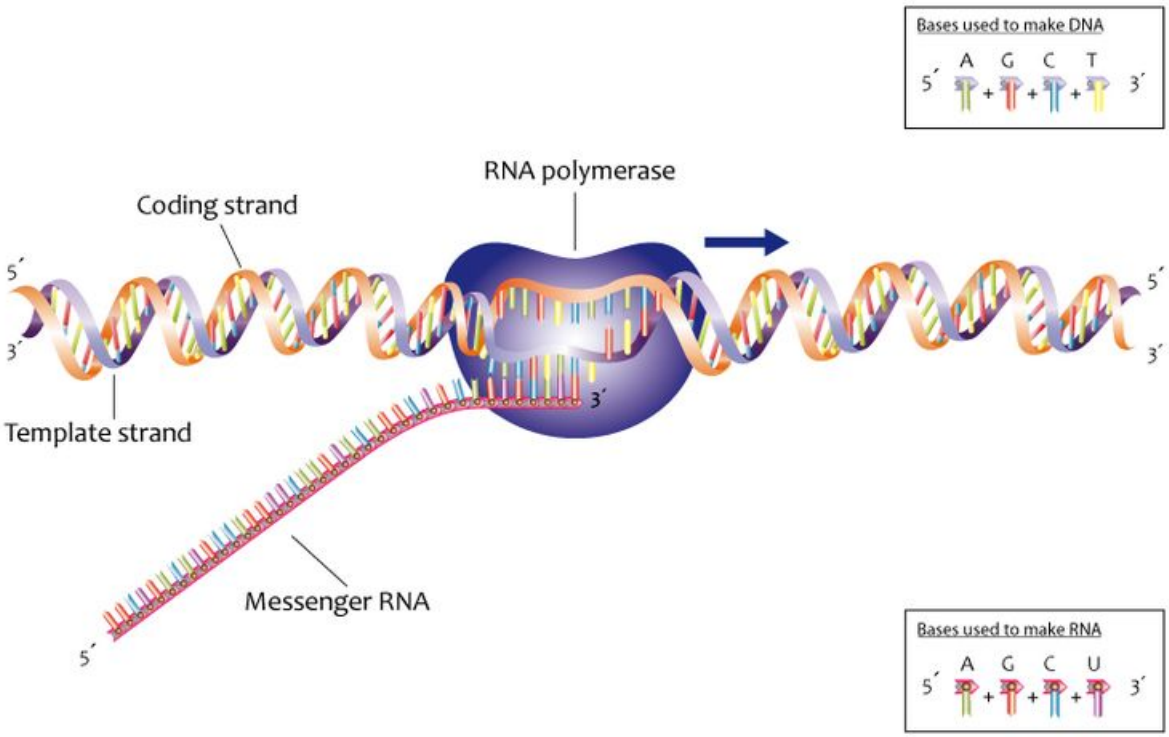
2. RNA Polymerase

If DNA can't leave the nucleus, how is the information accessed by the ribosomes so that the information can be used to make the necessary cellular components?

If you want to take information from a reference from the library, you make a copy. Similarly, if your cell needs to make a protein, it makes a copy of that protein's "recipe" via **RNA polymerase**, which is a lot like DNA polymerase.

You can think of DNA and **mRNA**, also known as messenger RNA, as being in the same chemical "language". They are both nucleic acids, and the "copy" mRNA makes of a gene's nucleotide sequence is complementary

to the DNA the way the DNA's other strand is complementary. So you make a copy (an RNA message) of a gene (a DNA "recipe") within the nucleus, then the mRNA moves from the nucleus to the endoplasmic reticulum.



Using mRNA as the go-between for DNA and ribosomes has a lot of advantages. For example, if you only need to make one "recipe" (one protein), it would be silly to lug the entire "recipe book" (your **genetic code**—all of your DNA's gene "recipes") out of the "library" (the nucleus). You don't need to make every single recipe in the recipe book all the time; mRNA allows you to copy only those proteins you need at any given moment. Because mRNA is single-stranded (only one strand of the DNA codes for a particular gene, so you only need to copy one strand) and mRNA made of ribose sugar instead of deoxyribose (as DNA is), mRNA is much more unstable. This means that it will degrade quickly, so once you have enough protein, the mRNA message won't linger and force you to keep making a protein you don't need anymore.

TERMS TO KNOW

RNA Polymerases

An enzyme used to form a single strand of RNA from a DNA strand.

mRNA

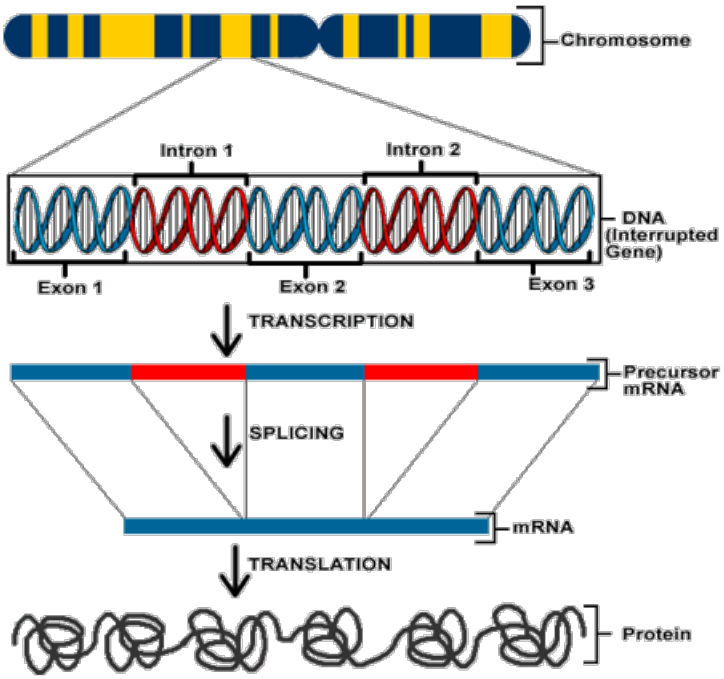
Messenger RNA that is used to make a copy of a gene that can leave the protection of the nucleus and give instructions for converting that nucleic information into functional protein.

Genetic Code

Information stored in the nucleotide sequence of DNA that forms our genes.

3. Introns and Exons

At this point, you may be wondering, "If there's DNA that contains my genetic code, what else does it contain?" Quite a lot, actually. Indeed, about 98% of your DNA doesn't code for protein directly; rather, it performs subtler functions. For example, within a gene, you will have stretches of sequence that get translated into protein, called **exons**. Between them, you will have introns; instead of getting translated into protein, introns are nucleotide sequences that recruit regulator proteins. **Regulatory proteins** modulate the timing and amount of a gene's expression into protein. They can even alter the protein into different versions that perform similar but subtly different functions.



TERMS TO KNOW

Exons

Sections of RNA that code for proteins.

Regulatory Proteins

Proteins that can stop or speed up transcription.

SUMMARY

Transcription is the first step in the process of using genes to build proteins. DNA is used as a template for RNA to be built, which is involved with **RNA polymerases**. The RNA that plays a role in transcription is mRNA. Depending on the nucleotides that line up in this mRNA, it forms which then code for specific amino acids. Also, within a gene, you will have stretches of sequence that get translated into protein, called **exons and introns**.

Keep up the learning and have a great day!

Source: This work is adapted from Sophia Author Amanda Soderlind

ATTRIBUTIONS

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TERMS TO KNOW

Exons
Sections of RNA that code for proteins.

Genetic Code
Information stored in the nucleotide sequence of DNA that forms our genes.

Protein Synthesis
The formation of proteins by using information stored in DNA.

RNA Polymerases
Enzymes used to form a single strand of RNA from a DNA strand.

Regulatory Proteins
Molecules that can modulate the production of certain target proteins.

Transcription
The process of converting DNA into RNA.

mRNA
Messenger RNA that is used to make a copy of a gene that can leave the protection of the nucleus and give instructions for converting that nucleic information into functional protein.