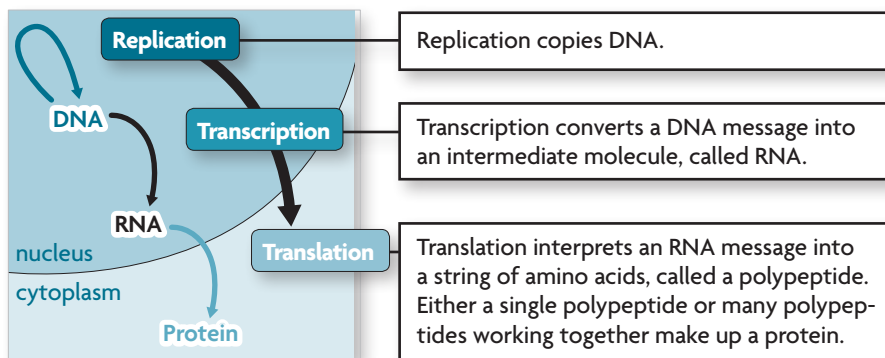


8.4 Transcription

KEY CONCEPT Transcription converts a gene into a single-stranded RNA molecule.

RNA carries DNA's instructions.

The **central dogma** describes how information from DNA gets used to make proteins. The central dogma involves three processes.



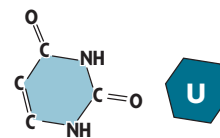
These processes are similar in prokaryotes and eukaryotes, but there are important differences. Here, we will look at these processes in eukaryotic cells.

RNA stands for ribonucleic acid. RNA, like DNA, is made of nucleotides with three parts: a sugar, a phosphate group, and a nitrogen-containing base. RNA is different from DNA in three important ways.

1. The sugar in RNA is ribose, not deoxyribose as in DNA. Ribose has one more oxygen atom than deoxyribose.
2. RNA has four bases: A, C, G, and U. RNA has the base uracil (U) instead of thymine (T). Uracil (U) pairs with adenine (A).
3. RNA is a single strand of nucleotides, not a double strand like DNA. The single-stranded structure of RNA allows an RNA molecule to fold up into complex three-dimensional shapes.

Connecting CONCEPTS

DNA Structure As you learned in Section 8.2, nucleotides are made of a phosphate group, a sugar, and a nitrogen-containing base. In DNA, the four bases are adenine, cytosine, guanine, and thymine. In RNA, uracil (below) replaces thymine and pairs with adenine.



What are three ways RNA differs from DNA? _____

Transcription makes three types of RNA.

Transcription is the process of copying a sequence of DNA to produce a complementary* strand of RNA. Only a piece of DNA, or a gene, gets transcribed into RNA, not the whole strand of DNA. Just as DNA polymerases help with replication, an enzyme called **RNA polymerase** helps with transcription.

* ACADEMIC VOCABULARY

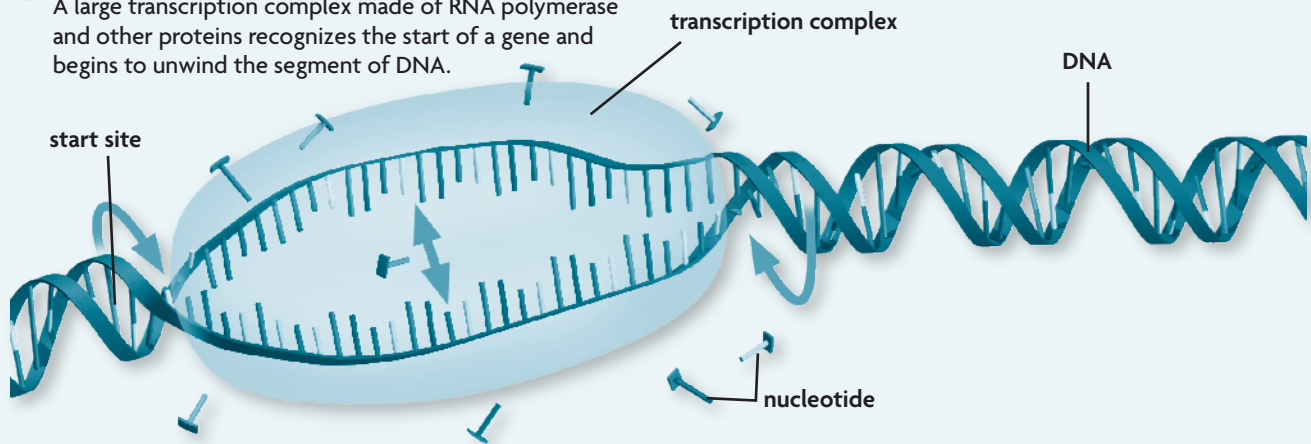
complementary matching

TRANSCRIPTION

Transcription produces an RNA molecule from a DNA template. Like DNA replication, this process takes place in the nucleus in eukaryotic cells and involves both DNA unwinding and nucleotide base pairing.

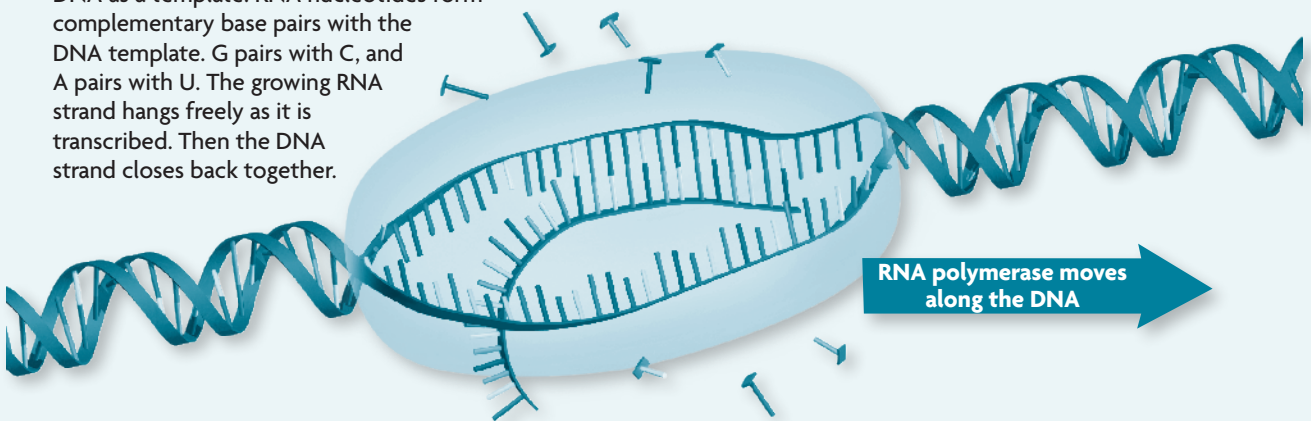
1

A large transcription complex made of RNA polymerase and other proteins recognizes the start of a gene and begins to unwind the segment of DNA.



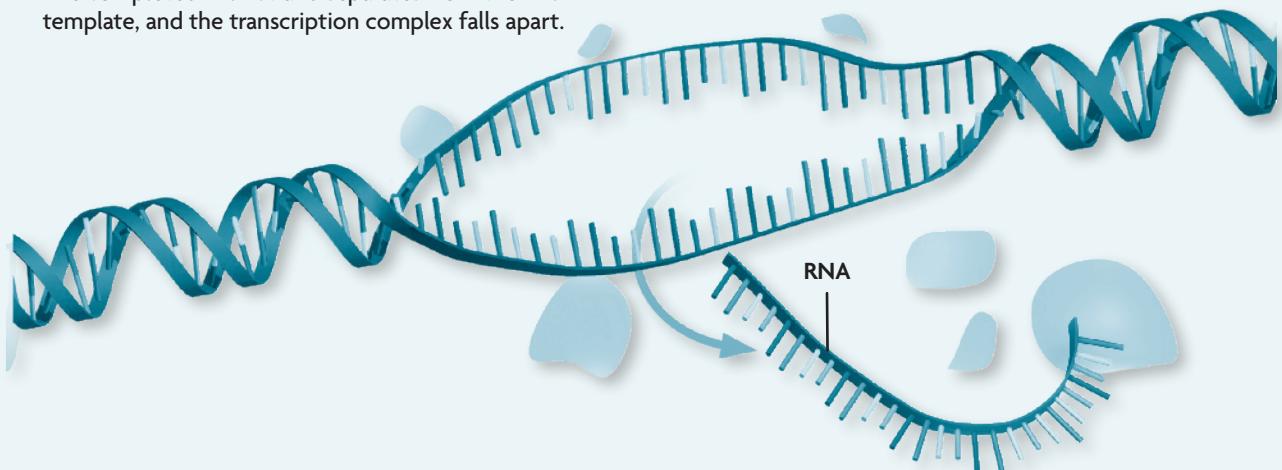
2

RNA polymerase uses one strand of the DNA as a template. RNA nucleotides form complementary base pairs with the DNA template. G pairs with C, and A pairs with U. The growing RNA strand hangs freely as it is transcribed. Then the DNA strand closes back together.



3

The completed RNA strand separates from the DNA template, and the transcription complex falls apart.



Transcription makes three different types of RNA molecules.

- **Messenger RNA (mRNA)** carries a message—the instructions that later get turned into a protein.
- **Ribosomal RNA (rRNA)** forms part of ribosomes, the parts of a cell that put amino acids together in a polypeptide.
- **Transfer RNA (tRNA)** transfers amino acids in the cytoplasm to the growing polypeptide.



Which type of RNA molecule carries the instructions that are read to form a protein?

The transcription process is similar to replication.

Transcription and replication share many similarities. For example, they both involve unwinding the DNA double helix, and both involve large enzymes called polymerases. But the end results of the two processes are very different. Replication makes a copy of DNA and transcription makes RNA molecules. Another difference is that replication happens only once during the cell cycle. Transcription can happen over and over on the same gene to make many copies of a particular RNA molecule.



What is one similarity between replication and transcription?

8.4 Vocabulary Check

central dogma	messenger RNA (mRNA)
RNA	ribosomal RNA (rRNA)
transcription	transfer RNA (tRNA)
RNA polymerase	

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold**.



1. What are three types of RNA molecules? _____

2. What process makes RNA from a DNA sequence? _____

8.4 The Big Picture

3. Label the drawing to the right with the names of the three processes involved in the central dogma.

