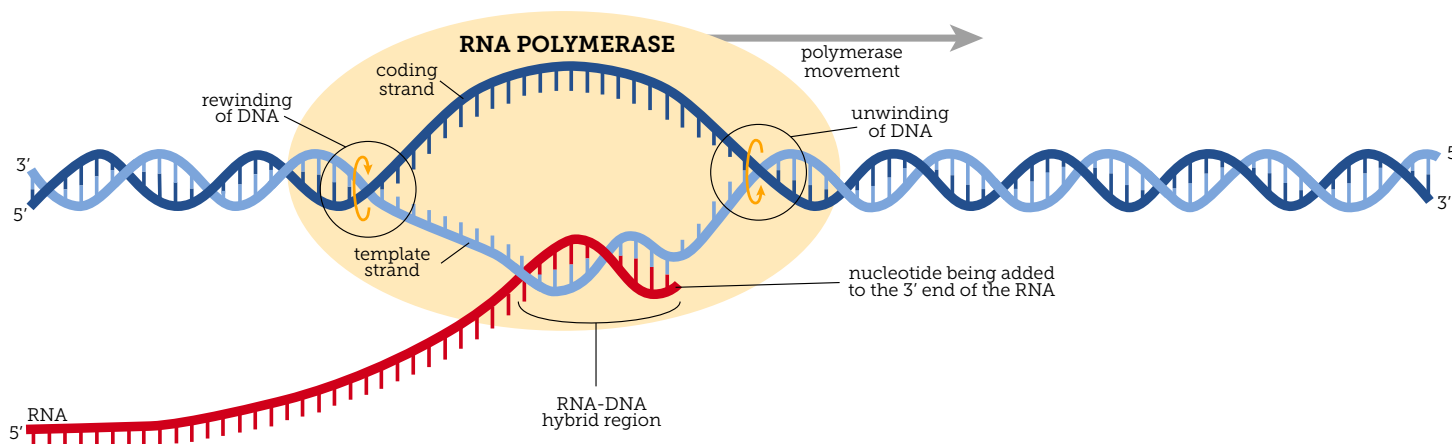


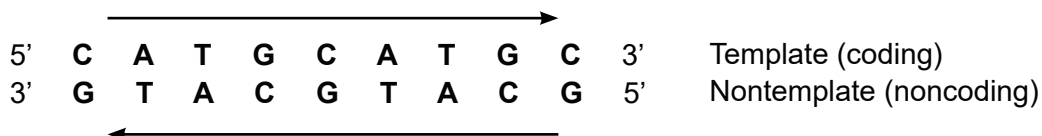
Teacher Guide

Part 3 - Modeling DNA Function: Transcription

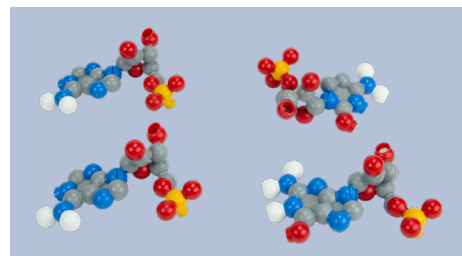


DNA inherited by an organism leads to specific characteristics determined by the synthesis of proteins from RNA molecules. **This flow of genetic information from DNA to RNA to protein is a central principle in biology.**

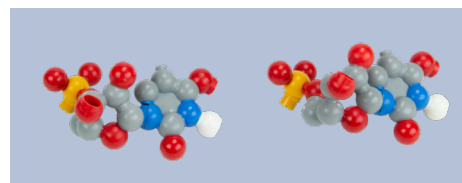
Transcription is the synthesis of RNA using the information stored in the DNA. To teach 3-dimensional aspects of **RNA transcription** using one 12 base pair set of *Dynamic DNA*®, we suggest that you use the following DNA sequence:



Before you begin the transcription process, convert two adenine (A) nucleotides, one guanine (G) nucleotide and one cytosine (C) nucleotide into the corresponding RNA nucleotides by adding an oxygen to the 2' carbon of the sugar. Set these pieces aside. Refer to the assembly instructions if you need directions.



Convert two thymine (T) nucleotides into uracil (U) nucleotides by removing the methyl group from the fifth position in the nitrogen ring and adding an oxygen to the 2' carbon of the sugar. Set these pieces aside. Refer to the assembly instructions if you need directions.



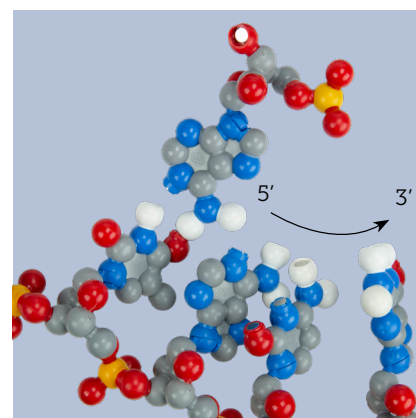
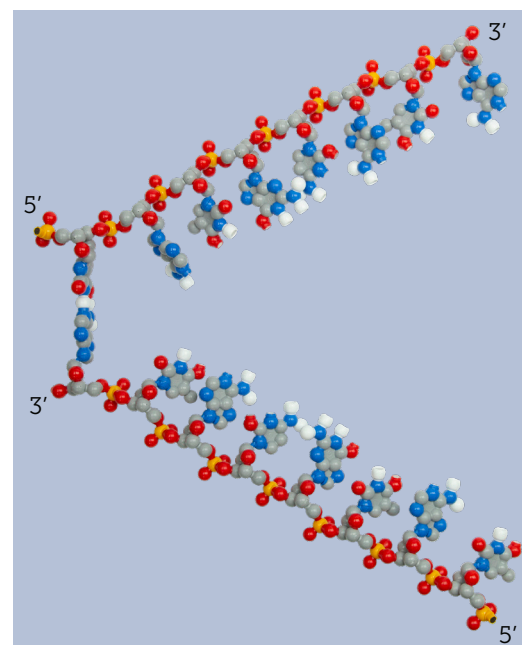
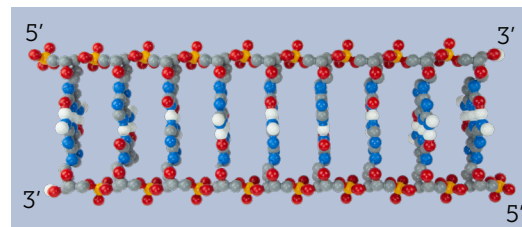
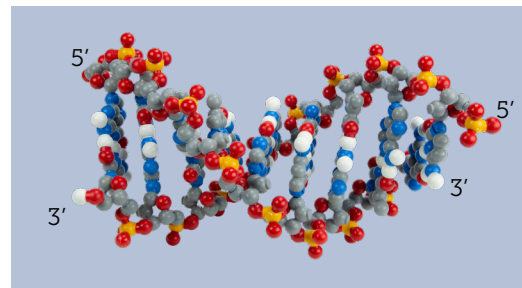
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Assemble 9 DNA base pairs to form a double helix using the suggested sequence above. You will use the remaining 6 converted nucleotides to form the messenger RNA.

Untwist the DNA double helix.

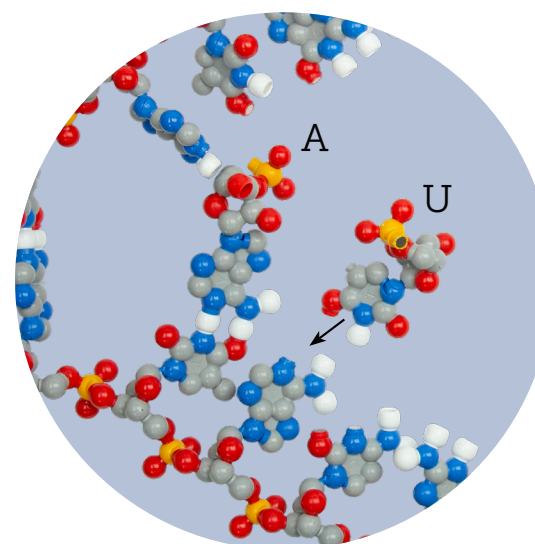
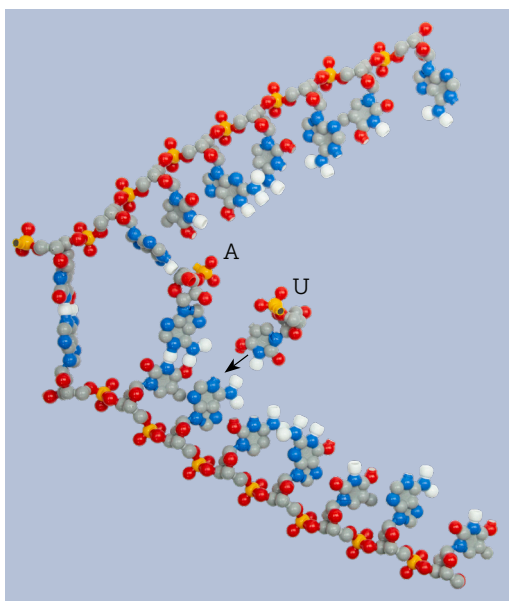
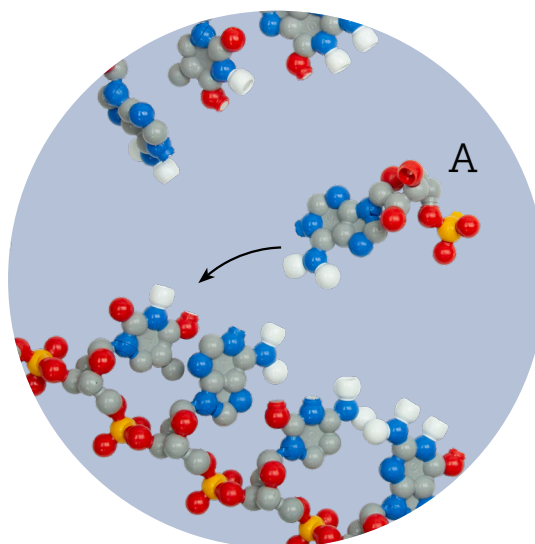
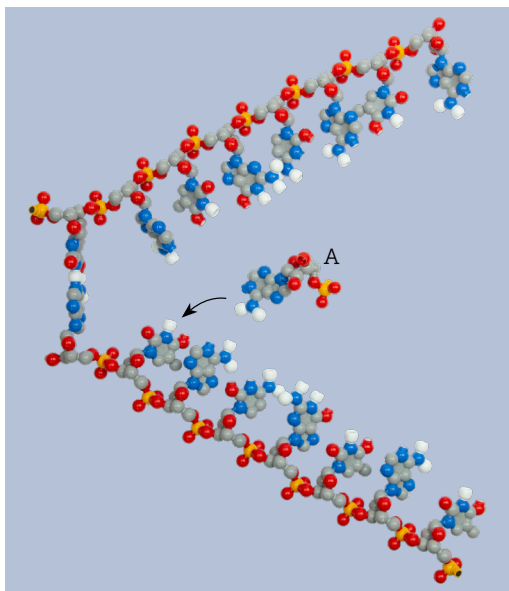
Separate the two strands, keeping the first base pair together.

Students act out the role of RNA polymerase, which binds to the template strand of the DNA, to begin synthesis of mRNA that is complementary and anti-parallel to the DNA template strand. Keep in mind that mRNA is synthesized from its 5' → 3' end beginning with the start codon AUG.

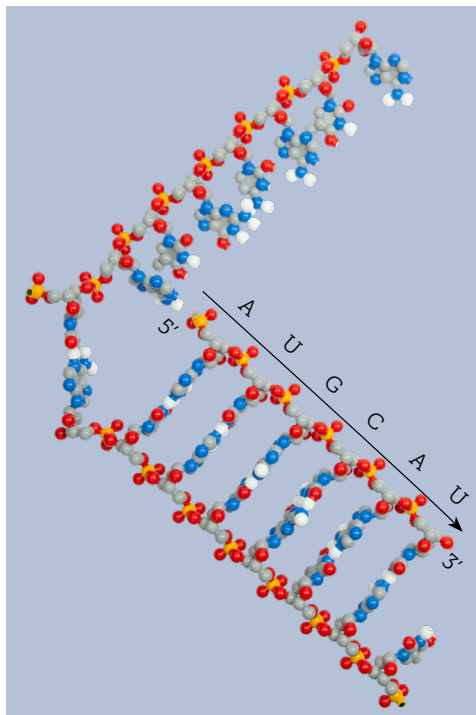


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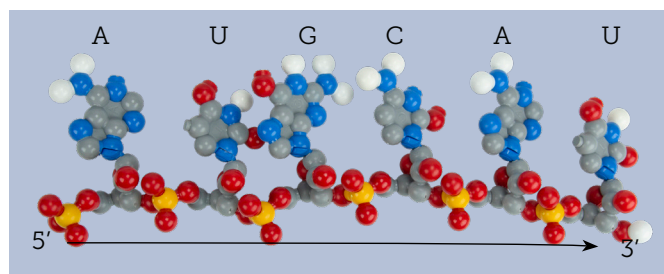
Continue adding the complementary RNA nucleotides.



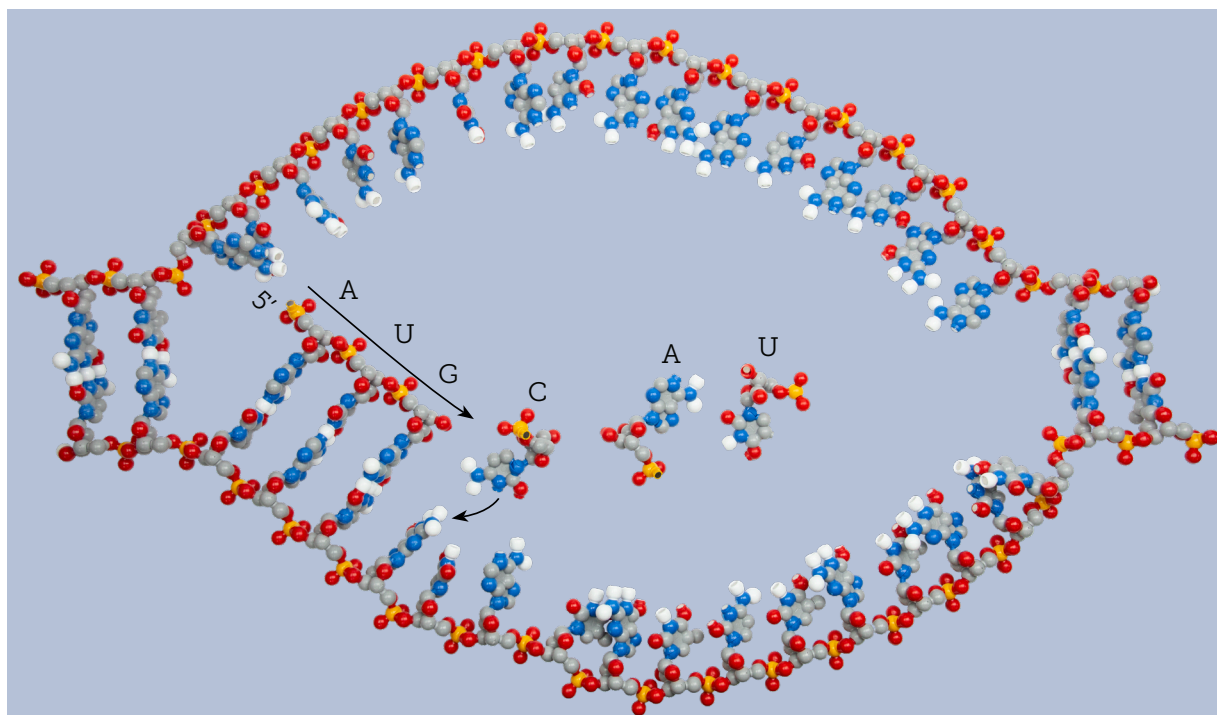
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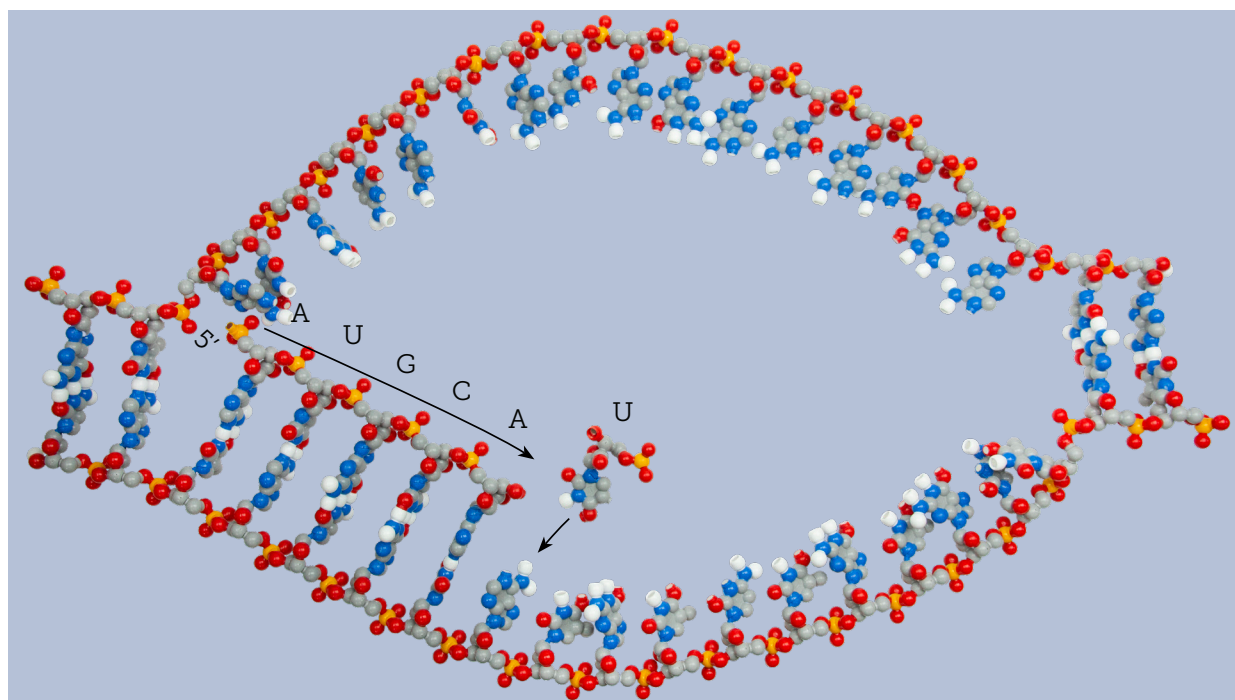
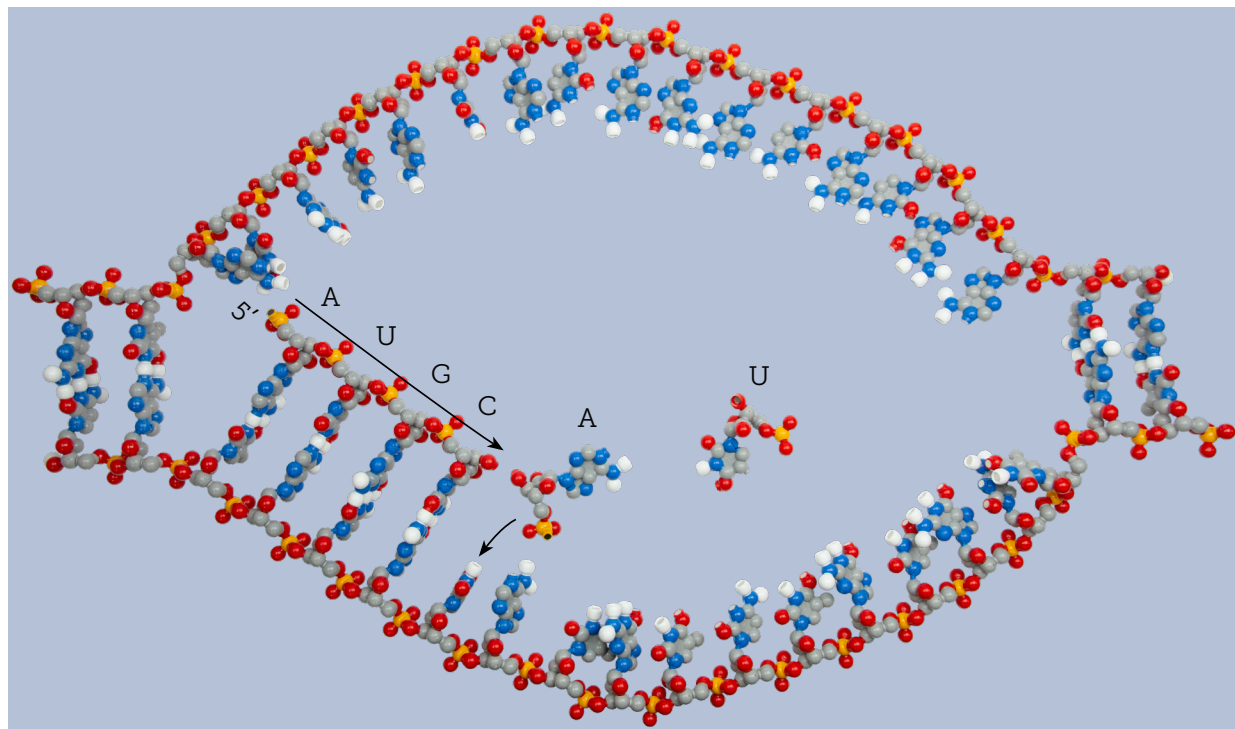
A newly synthesized mRNA is 6 nucleotides in length. Be sure to cap the phosphate and hydroxyl ends.



If 3 or more *Dynamic DNA Kits®* are available, you can create a bubble to model transcription.



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Teacher Guide

Going Further with Transcription....

- Consider how the RNA polymerase *knows* which strand, and *in what* direction, to copy the DNA message.
- Investigate RNA processing:
 - How are the two ends of the mRNA protected from degradation by exonucleases that would otherwise shorten the lifetime of the mRNA?
 - How can the mRNA be modified through splicing?
 - Keeping splicing in mind, how might the discrepancy between the number of human protein-coding genes (about 25,000) and the 100,000 different proteins made by human cells be explained?