Transcription Flip-Book

OBJECTIVE

The student will identify the steps involved in the process of transcription. The student will define vocabulary associated with the transcription process.

ACTION

1. Give a brief overview of transcription using the background information.
2. Explain that each student is going to create a transcription flip-book that outlines the steps involved in the transcription process.
3. Hand out one complete set of flip sheets to each student and instruct them to cut all of the picture cards out. Each of the picture cards represents a chronological step involved in transcription.
4. Instruct students to place the picture cards in the chronological order of the transcription process. The students should write a description of the picture on the back of the card. The description should include a definition of any vocabulary words on the front of the card as well as a detailed explanation of the transcription step pictured.
5. Review the process of transcription in detail and check students' answers using the teacher's guide.
6. Instruct students to staple their picture cards together. Next, students can flip the pages of the book to see all the steps involved in transcription come to life with detailed explanations of each step on the back.
7. Review that the purpose of the transcription process is to create an mRNA molecule that will eventually be translated into a protein. All animals utilize proteins in some way and some are specific to different animal species.
8. Divide the class into groups of four or five.
9. Hand out one research question (from the Animal-mRNA Funsheet) and an Animal-mRNA table to each group. Explain that each group is going to construct an mRNA molecule that is specific to a certain species of animal.
10. Ask students to refer back to their transcription flipbooks and proceed to the page that introduces the initiation or start site. Explain that the entire class has the exact sequence of nitrogenous bases listed in the exact order following the promotor site. In order to answer their question, each group will have to modify this sequence of DNA on the template strand. The questions are preceded by a set of instructions that

outline the procedure for modifying their DNA sequence. Ex: Starting at the initiation site, change the third nitrogenous base to Cytosine from Thymine.

11. Ask students to write down the new DNA sequence after it has been modified by their specific group's instructions. Next, instruct students to determine the new corresponding mRNA sequence to their DNA strand. Each student group will have a different DNA and corresponding mRNA sequences (Six versions for the entire class).
12. Explain that each group's mRNA sequence will eventually (after it has gone through the translation process) code for a protein specific to a different animal species. Instruct students to correlate their mRNA sequences to the animal proteins they represent using the Animal-mRNA table.

VOCABULARY

antisense strand: The strand of DNA that is not actively used as a template in the transcription process.
codon: A three-nucleotide sequence of DNA or mRNA that specifies a particular amino acid or termination signal and that functions as the basic unit of the genetic code.
double Helix: The form of native DNA, referring to its two adjacent polynucleotide strands wound into a spiral shape.
DNA: (Deoxyribonucleic acid) A double-stranded, helical nucleic acid molecule, capable of replicating and determining the inherited structure of a cell's protein.
exon: The coding region of a eukaryotic gene that is expressed. Exons are separated from each other by introns.
genetics: The science of heredity; the study of heritable information.
gene: One of many discrete units of hereditary information located on the chromosomes and consisting of DNA.
intron: The noncoding, intervening sequence of coding region (exon) in eukaryotic genes.
promoter: A specific nucleotide sequence in DNA, flanking the start of a gene; instructs RNA polymerase where to start transcribing RNA.
protein: A three-dimensional biological polymer constructed from a set of 20 different monomers called amino acids.
RNA: (Ribonucleic acid) A single-stranded nucleic acid molecule involved in protein synthesis, the structure of which is specified by DNA.
RNA polymerase: An enzyme that links together the growing chain of ribonucleotides during transcription.
RNA splicing: The removal of noncoding portions of the RNA molecule after initial synthesis.
sense strand: The strand of DNA that is actively used as a template in the transcription process.
transcription: The transfer of information from DNA molecule into an RNA molecule.
translation: The transfer of information from an RNA molecule into a polypeptide, involving a change of language from nucleic acids to amino acids.
triplet code: A set of three-nucleotide-long words that specify the amino acids for polypeptide chains.

MATERIALS

For each student:
- one copy of flip sheets
- one stapler
- one pair scissors
- one Animal-mRNA Table
- one Animal-mRNA Funsheet
- 20 5x8 index cards
- one Animal-mRNA Table (per group)

For class:
- one Teacher's Guide (per class)

Preparation:
Photocopy the flips sheets and the Animal-mRNA table for each student group. Separate and cut each group's research question from the Animal-mRNA Funsheet.

*Activity adapted from Enzyme Action: Flip Books for Science Processes. <http://www.accessexcellence.org/AE/ATG/data/released/0165-MarkPorter/index.html>

Animal mRNA Table

mRNA	Protein
GUG GCU AUG	Codes for a Rhino Protein
GUG ACC CUA	Codes for an Asian Elephant Protein
GUG AAG CUG	Codes for a Serval Protein
GGG ACU CCG	Codes for a Goat Protein
GUU ACU AUG	Codes for a Porcupine Protein
GUA CCU CUG	Codes for a Rat Protein

Animal mRNA Funsheet

RESEARCH QUESTION 1

What animal specific protein will eventually be translated from the following mRNA molecule template?

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA

Starting at the initiation site, change the fourth nitrogenous base from Thymine to Cytosine and the seventh nitrogenous base from Guanine to Thymine.

Step Two: Determine the mRNA sequence from the changes in the DNA

Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA.

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table.

RESEARCH QUESTION 2

What animal specific protein will eventually be translated from the following mRNA molecule template?

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA

Starting at the initiation site, change the sixth nitrogenous base from Adenine to Guanine and the ninth nitrogenous base from Cytosine to Thymine.

Step Two: Determine the mRNA sequence from the changes in the DNA

Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA.

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table.

RESEARCH QUESTION 3

What animal specific protein will eventually be translated from the following mRNA molecule template?

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA

Starting at the initiation site, change the fifth nitrogenous base from Guanine to Thymine and the sixth nitrogenous base from Adenine to Cytosine.

Step Two: Determine the mRNA sequence from the changes in the DNA

Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA.

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table.

RESEARCH QUESTION 4

What animal specific protein will eventually be translated from the following mRNA molecule template?

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA

Starting at the initiation site, change the second nitrogenous base from Adenine to Cytosine and the eighth nitrogenous base from Adenine to Guanine.

Step Two: Determine the mRNA sequence from the changes in the DNA

Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA.

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table.

RESEARCH QUESTION 5

What animal specific protein will eventually be translated from the following mRNA molecule template?

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA

Starting at the initiation site, change the third nitrogenous base from Cytosine to Adenine and the seventh nitrogenous base from Guanine to Thymine.

Step Two: Determine the mRNA sequence from the changes in the DNA

Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA.

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table.

RESEARCH QUESTION 6

What animal specific protein will eventually be translated from the following mRNA molecule template?

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA

Starting at the initiation site, change the third nitrogenous base from Cytosine to Thymine and the fourth nitrogenous base from Thymine to Guanine.

Step Two: Determine the mRNA sequence from the changes in the DNA

Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA.

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table.

Animal mRNA Teacher Guide

RESEARCH QUESTION 1

What animal specific protein will eventually be translated from the following mRNA molecule template? *Rhino Protein*

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA Starting at the initiation site, change the fourth nitrogenous base from Thymine to Cytosine and the seventh nitrogenous base from Guanine to Thymine. *CAC CGA TAC*

Step Two: Determine the mRNA sequence from the changes in the DNA.Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA. *GUG GCU AUG*

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table. *Codes for a Rhino Protein*

RESEARCH QUESTION 2

What animal specific protein will eventually be translated from the following mRNA molecule template? Asian Elephant Protein

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA Starting at the initiation site, change the sixth nitrogenous base from Adenine to Guanine and the ninth nitrogenous base from Cytosine to Thymine. *CAC TGG GAT*

Step Two: Determine the mRNA sequence from the changes in the DNA. Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA. *GUG ACC CUA*

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table. *Codes for an Asian Elephant Protein*

RESEARCH QUESTION 3

What animal specific protein will eventually be translated from the following mRNA molecule template? *Serval Protein*

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA. Starting at the initiation site, change the fifth nitrogenous base from Guanine to Thymine and the sixth nitrogenous base from Adenine to Cytosine. CAC TTC GAC

Step Two: Determine the mRNA sequence from the changes in the DNA Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA. *GUG AAG CUG*

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table. *Codes for a serval protein*

RESEARCH QUESTION 4

What animal specific protein will eventually be translated from the following mRNA molecule template? *Goat Protein*

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA Starting at the initiation site, change the second nitrogenous base from Adenine to Cytosine and the eighth nitrogenous base from Adenine to Guanine.*CCC TGA GGC*

Step Two: Determine the mRNA sequence from the changes in the DNA Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA. *GGG ACU CCG*

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table. *Codes for a goat protein*

RESEARCH QUESTION 5

What animal specific protein will eventually be translated from the following mRNA molecule template? Porcupine Protein

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA Starting at the initiation site, change the third nitrogenous base from Cytosine to Adenine and the seventh nitrogenous base from Guanine to Thymine. *CAA TGA TAC*

Step Two: Determine the mRNA sequence from the changes in the DNA Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA. *GUU ACU AUG*

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table. *Codes for a porcupine protein*

RESEARCH QUESTION 6

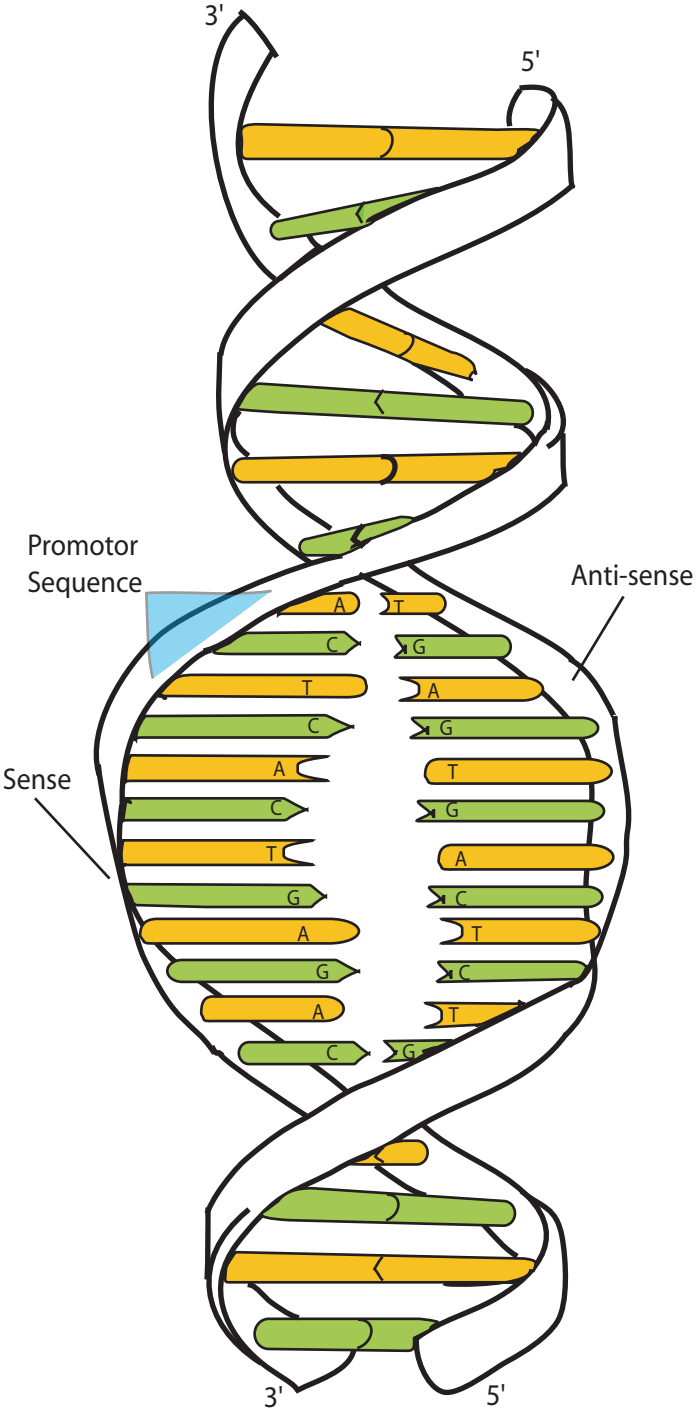
What animal specific protein will eventually be translated from the following mRNA molecule template? *Rat Protein*

Steps for determining mRNA Molecule Template

Step One: Modifying the DNA Starting at the initiation site, change the third nitrogenous base from Cytosine to Thymine and the fourth nitrogenous base from Thymine to Guanine. *CAT GGA GAC*

Step Two: Determine the mRNA sequence from the changes in the DNA Write down the modified DNA sequence and determine its complementary mRNA strand. Remember: Thymine is replaced by Uracil in RNA. *GUA CCU CUG*

Step Three: Correlate the mRNA strand to the animal specific proteins listed on the Animal mRNA Table. *Codes for a Rat protein*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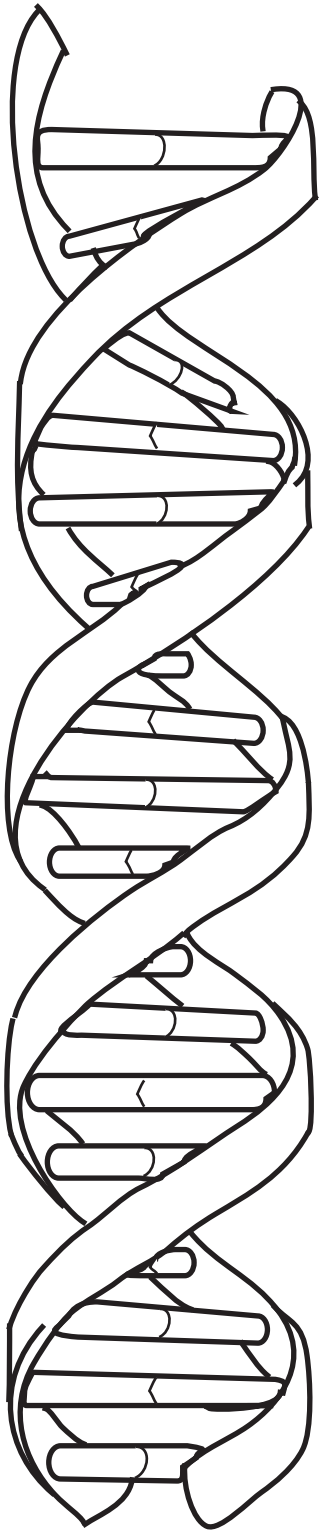

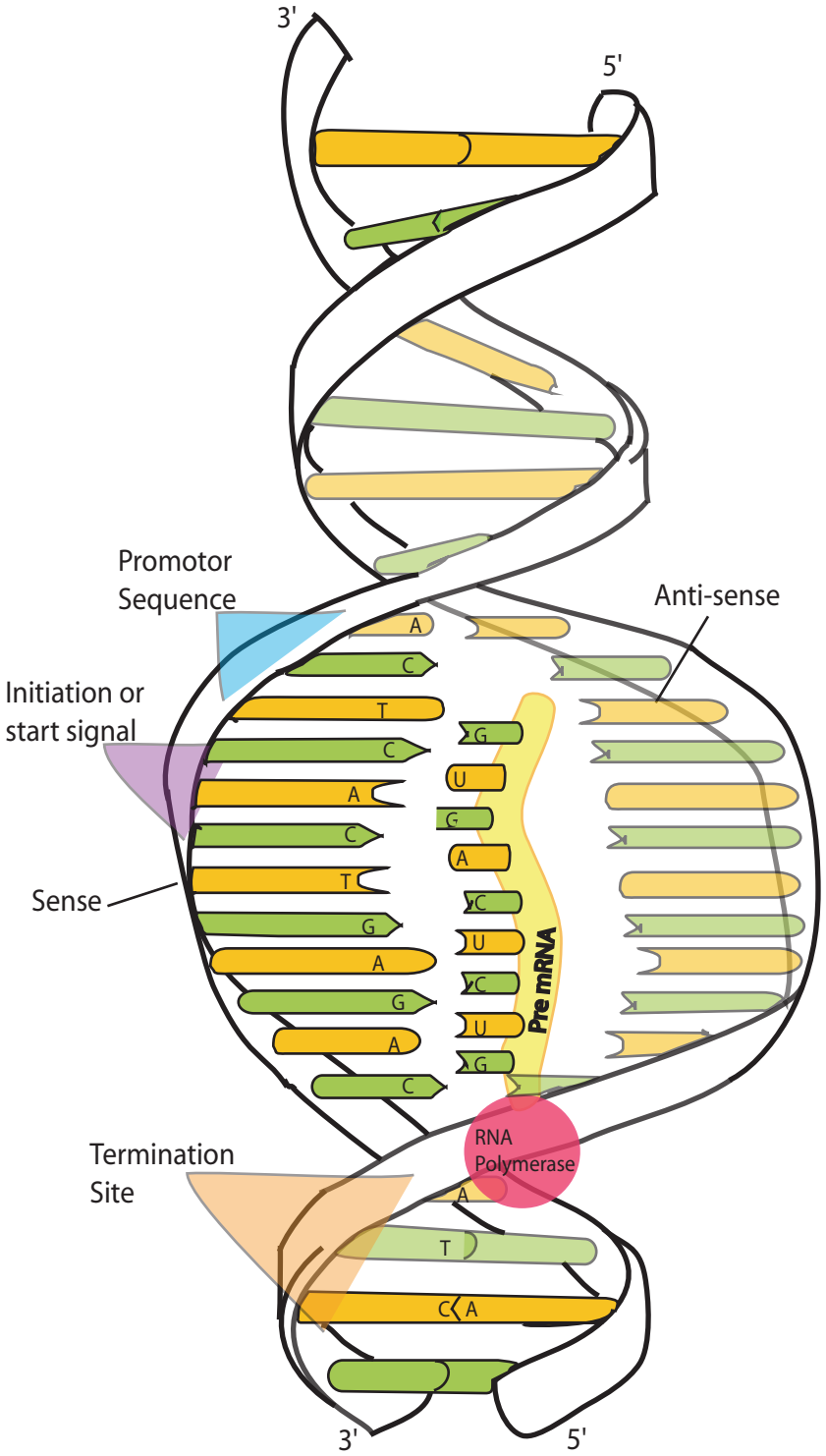
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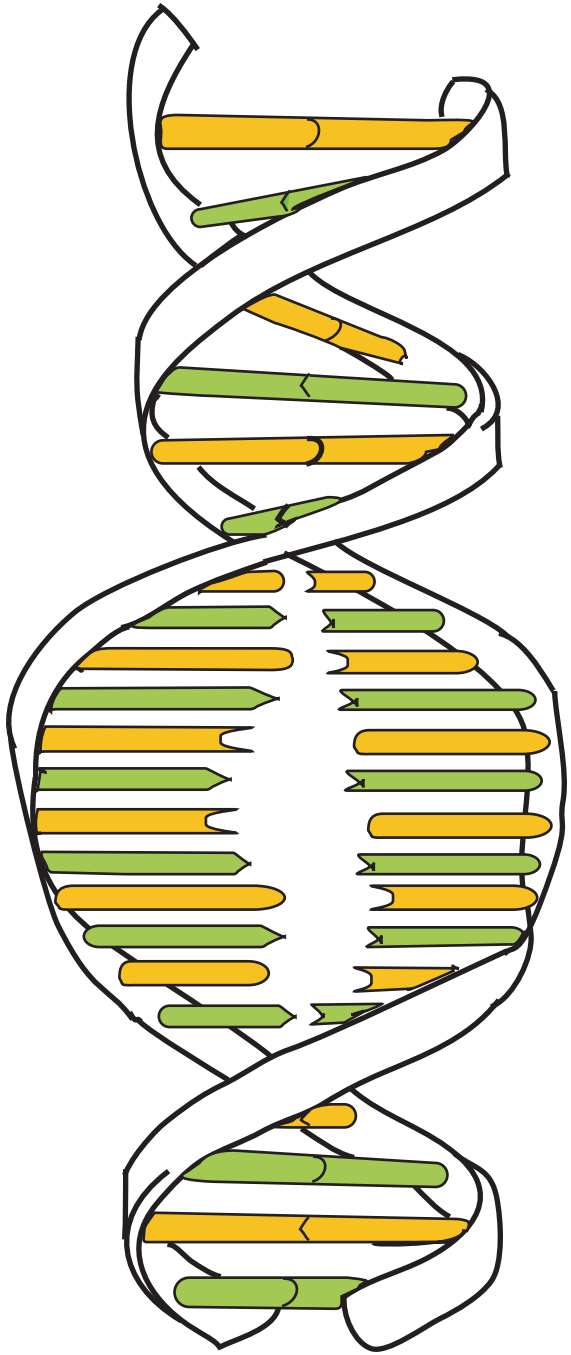

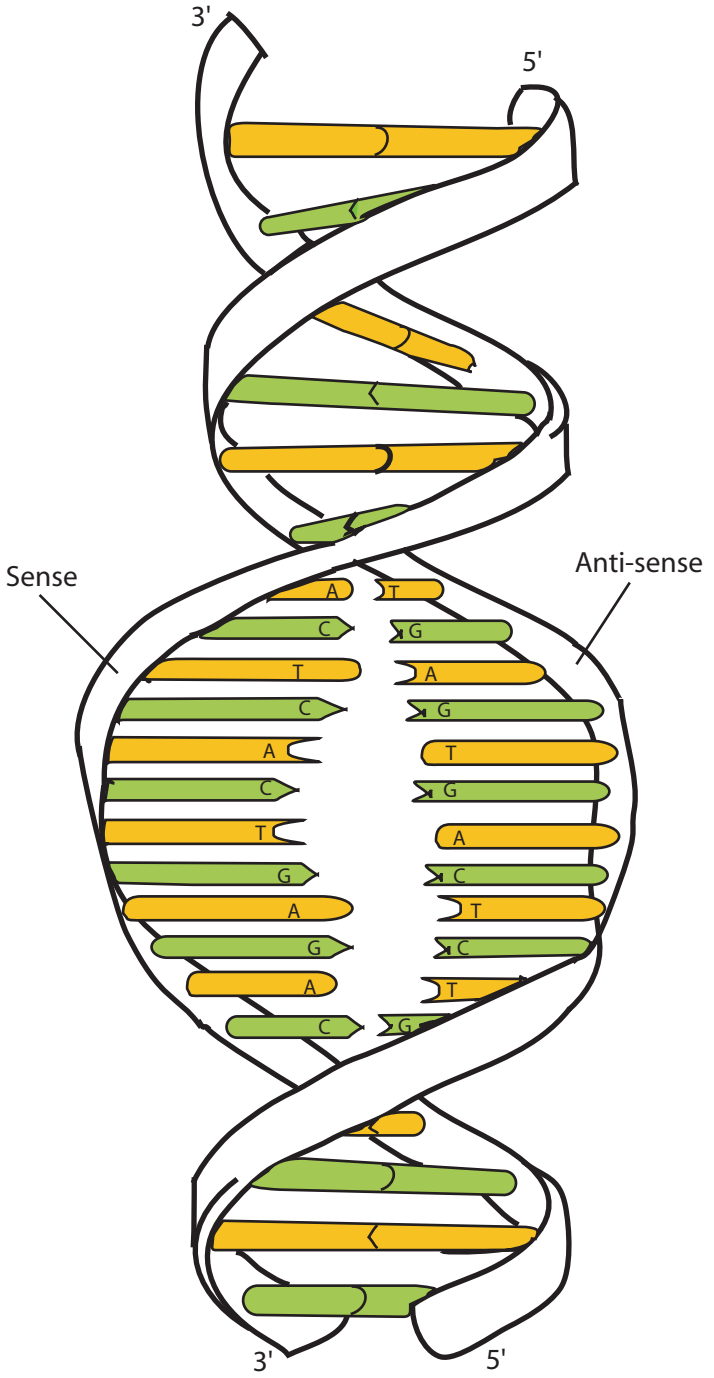
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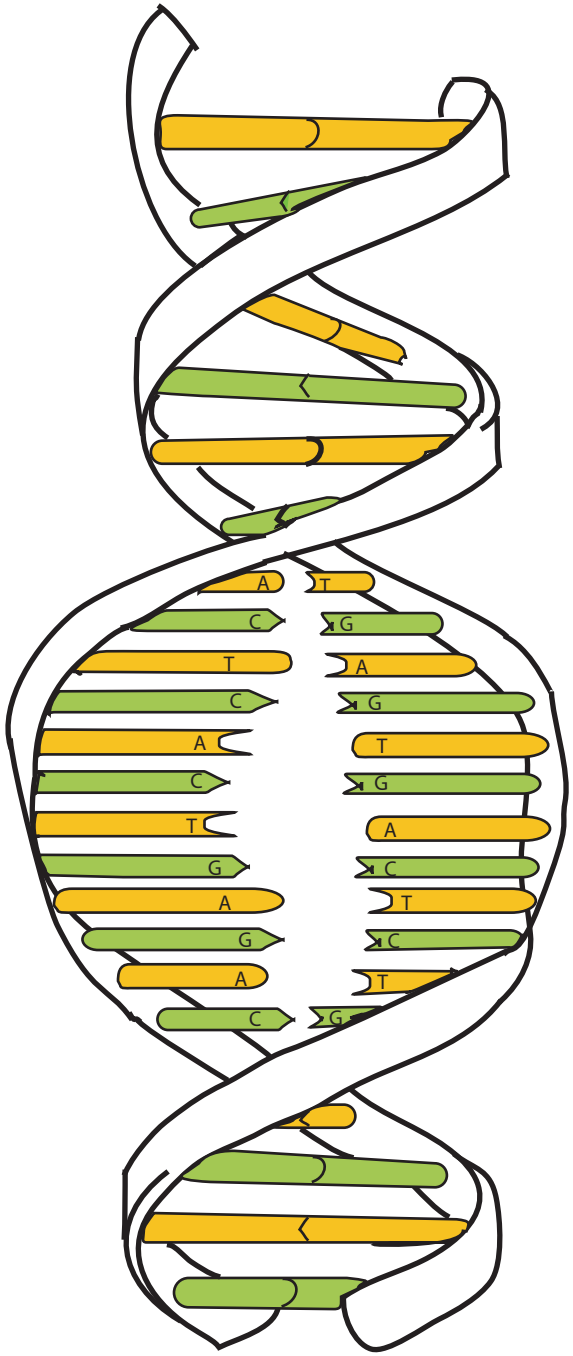
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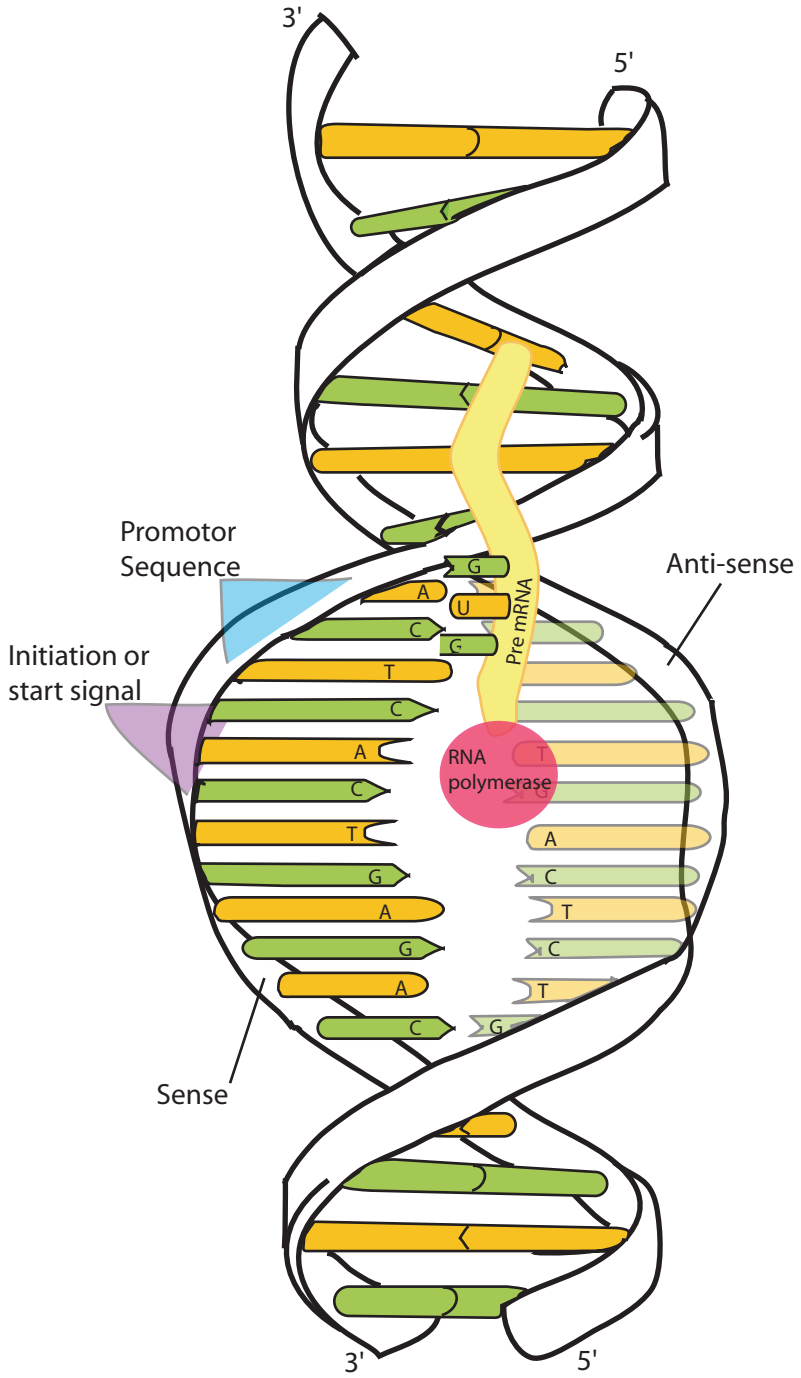
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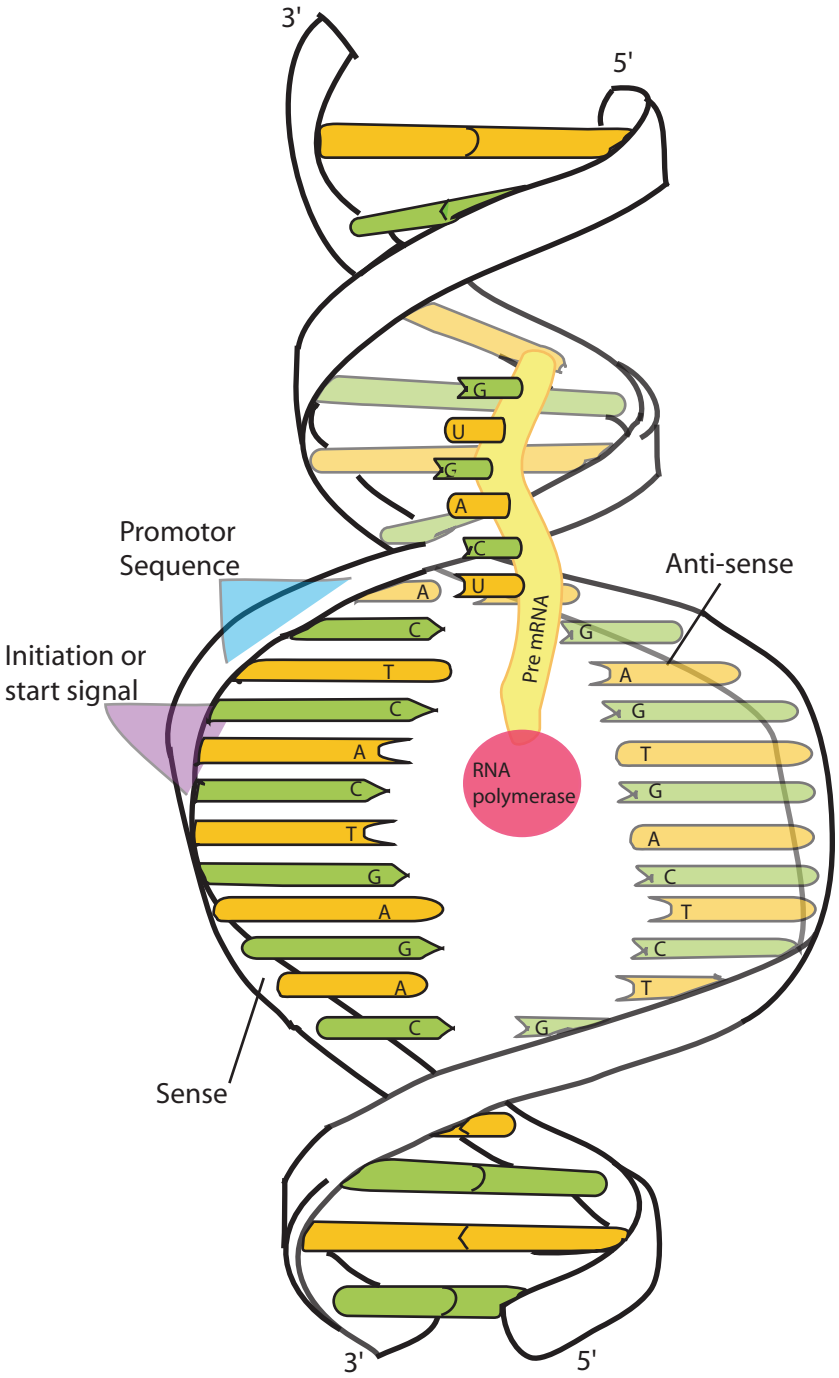
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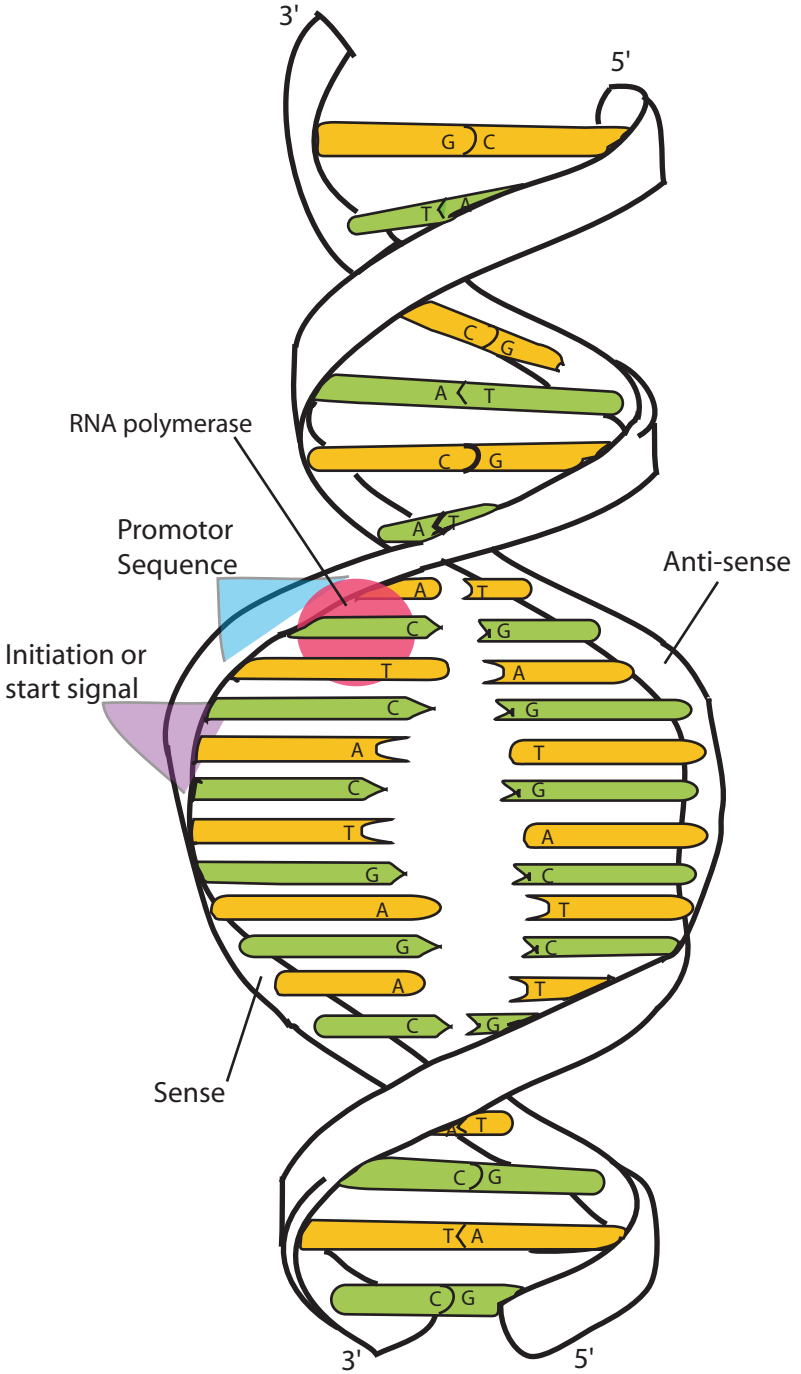
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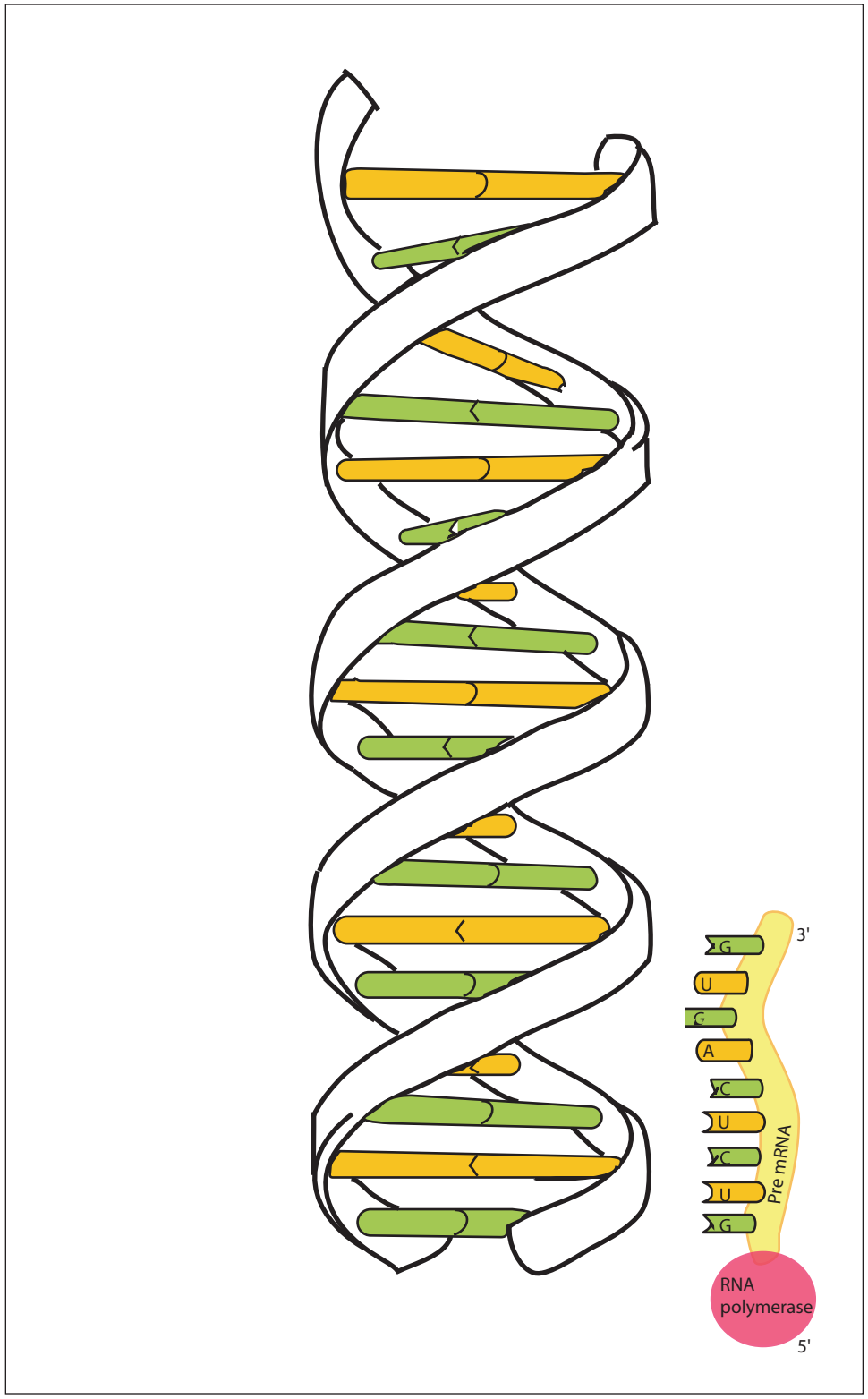
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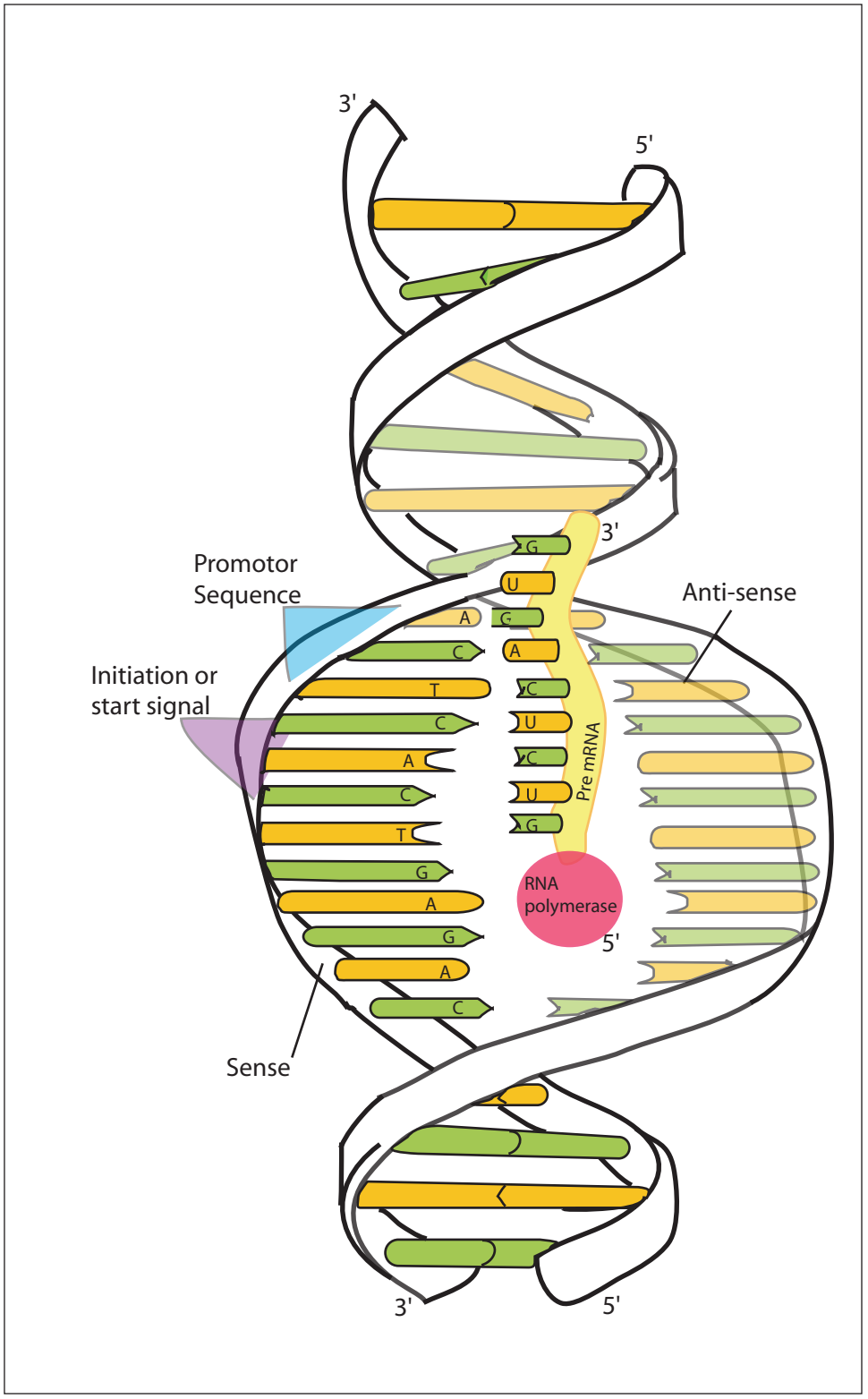
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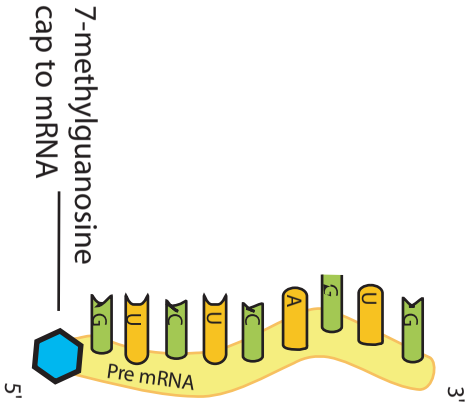
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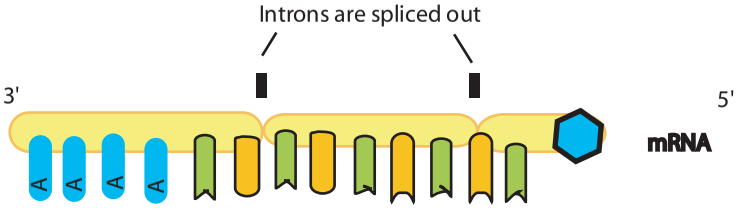
Introns are spliced out
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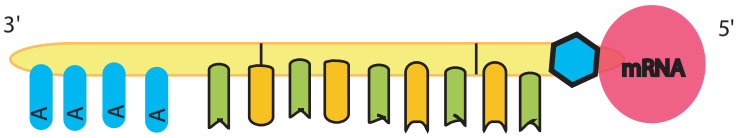
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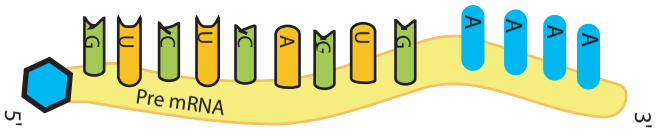
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