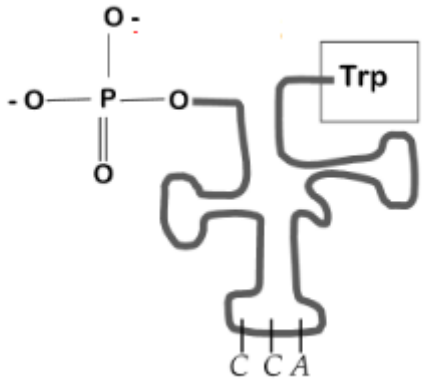
TD 6 (protein synthesis)

Exercise 1:

1. A portion of the coding strand (sense strand) for a given gene has the sequence 5′ATGAGCGACTTTGCGGGATTA 3

a) Deduce the non-coding strand (antisense strand), which strand is the transcribed strand?

(b) What are the mRNA and protein sequences that would be produced during transcription and translation of this DNA segment?



Exercise 2:

1) What does this diagram represent?

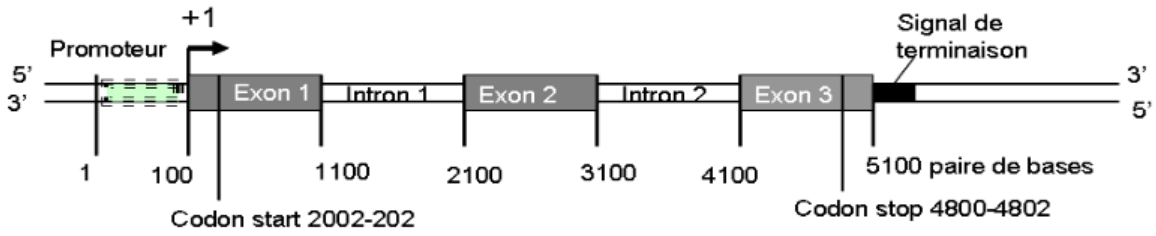
2) Determine the ends of this molecule?

3) What are the three nucleotides found at the end of the 3' end?

4) Give the nucleotides of the anticodon?

Exercise 3:

Below is a schematic representation of the Y gene, which encodes protein X. Transcription begins immediately after the promoter.



TD 6 (protein synthesis)

1) The primary transcript of this gene produced by RNA polymerase will be approximately how many nucleotides long?

2) Two different transcripts are produced from this gene, one is about 2000 nucleotides long, the other is about 3000 nucleotides long. Explain how two different transcripts can be produced from this gene?

3) Suppose each transcript produces a protein. Given the diagram above, what is the approximate size of the protein produced by the main transcript of this gene?

4) Suppose that gene Y was mutated such that the G/C base pair found at position 2200 awas replaced by an A/T. Would transcription and translation of the mutated gene Y still occur?

5) Would the protein produced be the same length, shorter or longer than the protein produced by the wild-type Y gene? Explain your answer.

Exercise 4:

Here is a DNA sequence consisting of 210 consecutive base pairs that corresponds to the beginning of the X gene sequence. Transcription begins at the T/A base pair at position 60 (In bold)

1) What are the first 6 nucleotides of the mRNA of gene X?
2) 2) What are the first 4 amino acids coded for by gene X? (A genetic code table can be found on the last page)

```
   1         10         20         30         40         50         60         70
   I---------I---------I---------I---------I---------I---------I---------I
5' ATCGGTCTCGGCTACTACATAAACGCGCGCATATATCGATATCTAGCTAGCTATCGGTCTAGGCTACTAC
3' TAGCCAGAGCCGATGATGTATTTGCGCGCGTATATAGCTATAGATCGATCGATAGCCAGATCCGATGATG
                                    Pomoteur
           80         90         100        110        120        130        140
   ---------I---------I---------I---------I---------I---------I---------I
5' CAGGTATCGGTCTGATCTAGCTAGCTTCTCTTCTCTCTCTCCCCCGCGGGGGCTGTACTATCATGCGTCG
3' GTCCATAGCCAGACTAGATCGATCGAAGAGAAGAGAGAGGGGGCGCCCCCGACATGATAGTACGCAGC

           150        160        170        180        190        200        210
   ---------I---------I---------I---------I---------I---------I---------I
5' TCTCGGCTACTACGTAAACGCGCGCATATATCGATATCTAGCTAGCTATCGGTCTCGGCTACTACGTAAA
3' AGAGCCGATGATGCATTTGCGCGCGTATATAGCTATAGATCGATCGATAGCCAGAGCCGATGATGCATTT
```

You found two different mutations of gene X, mutation 1 and mutation 2.

3) For mutation 1, there is an insertion of the three base pairs immediately after the C/G base pair at position 100 (in bold). 5'TGT3'

3'ACA5'

a) Would the mRNA expressed from this version of gene X be longer, shorter, or identical to the mRNA produced by the normal gene X? Explain, and if longer or shorter, indicate the number of bases.
b) b) If the mRNA is translated, would the protein produced be longer, shorter, or the same size as that produced by normal gene X? Will the protein produced have the same function as normal protein X ? Explain your thinking.

4) For mutation 2, there is a four base pair insertion immediately after the A/T base pair at position 130 (in bold). 5'ATGT3'

3'TACA5'

In this case:

c) What are the first four amino acids produced?
d) The protein produced would be longer, shorter, or the same size as that produced by the normal X gene? The protein produced will have the same function as the normal X protein ? Explain your thinking?